



AUDIT II

Guidebook for Energy Audit Programme Developers

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Foreword

The aim of this guidebook is to give energy audit programme developers clear and comprehensive guidance on the topics that need to be considered at the start and throughout the lifetime of an energy audit programme. Increase in energy efficiency requires that a sufficient number of energy audits will be undertaken at high quality. This will be achieved only by a well-planned programme level activity.

For some reason, when improving energy efficiency is the issue, there is a tendency to concentrate on new methods and new type of schemes. Energy audits have a long history in many countries and therefore might not have such a high attraction of novelty. However, it is very difficult to see how the cost-effective energy saving measures can be found without an expert, the energy auditor, making a good on-site study on the existing situation. In fact, as long as clairvoyants do not operate in this area, there is no other way to do it.

The question is not whether energy audits are needed or not but how to develop a programme, which will bring good results. Today this also means fulfilling the needs of the governments in their work against the climate change. A clean-cut energy audit programme is not the only answer. Energy audits can be used effectively also inside other type of programmes and schemes.

This guidebook has been produced as a part of SAVE II Programme project AUDIT II (2001–2003). The main aim of the AUDIT II project was to update the information on energy audit activities in the Member States and study the state-of-the-art approaches applied in the national energy audit programmes. Based on the collected information a guidebook, which can be utilised by programme developers of new programmes and operators of ongoing programmes, was developed. The project also initiated the establishment of a network of organisations responsible for operating the national energy audit programmes. The network was established as a Working Group (WGEA) within the EnR Network in February 2003 and is chaired by Ademe for the first two years.

The project team, “Team AUDIT”, want to express thanks to all those national experts who devoted their working time for the interviews as well for commenting the country reports. Assistance was also received from many national experts in the writing process of the country reports. This contribution has been the key to the successful implementation of our work.

The project team also express thanks to the European Commission for the received financial contribution from the SAVE II Programme and especially to Waltraud Schmid and Randall Bowie for their support and assistance.



Team AUDIT – the Authors of the Guidebook

The authors' sincere wish was to develop a guidebook where "the thread will run through the whole story" from the first sentence to the last dot of the last page. If something is still missing, the reason to that is that there is something new to be learned by us also. Writing this guidebook has been a challenging task – but it is the readers' judgement to say if we have succeeded in our aim.

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Summary

Programme level energy audit activities, both clean-cut energy audit programmes (EAP) and other programmes (OP) where energy audits play an important role, are quite well represented in the Member States and Norway as well as in the Central and Eastern European Countries (CEECs). Although the number of programmes does not give a full picture on the size and coverage of the activity, some level of energy auditing can be said to exist in more or less all countries covered by the AUDIT II project.

In the Member States and Norway the total number of clean-cut energy audit programmes is 13 in 7 countries. With other programmes, where energy audits are involved, the number is 29 in 15 countries. The number of non-programme level other activities promoting energy audits is 18. In the CEECs are today run total 3 energy audit programmes and 11 other programmes and in addition 15 non-programme level other activities promoting energy audits. The definitions vary between the countries. Energy audits can be found under headings “assessment”, “survey”, “decision making” but also under headings like “labelling” and “certification”. The classification between the energy audit programmes and the other programmes might be in some cases just an academic question. All energy audit programmes, other programmes and other activities found in the AUDIT II project are presented as an appendix. An overview on the “existence” is given in the following maps.

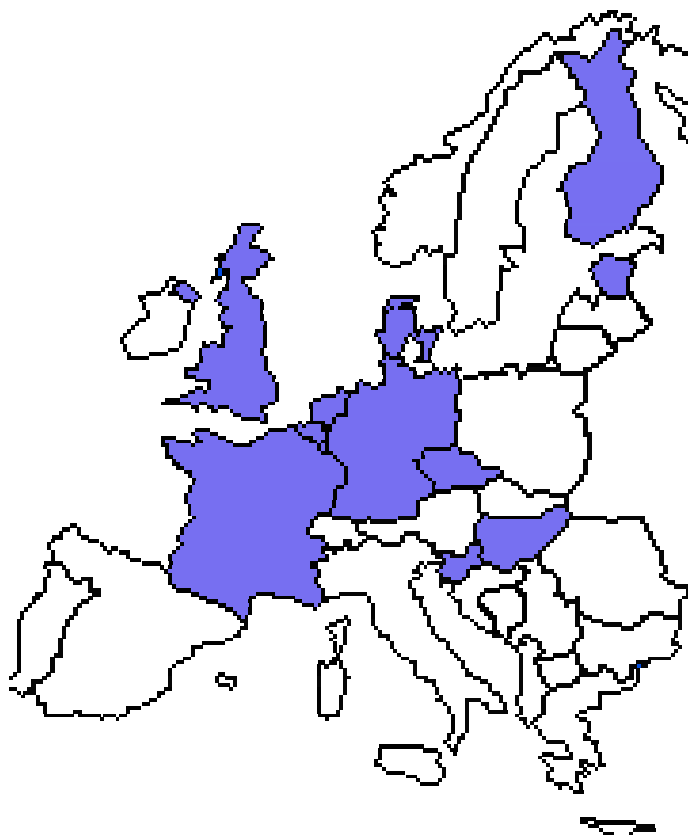


Figure 1 Energy audit programmes in the Member States, Norway and the CEECs



Figure 2 Other programmes with energy audits in the Member States, Norway and the CEECs

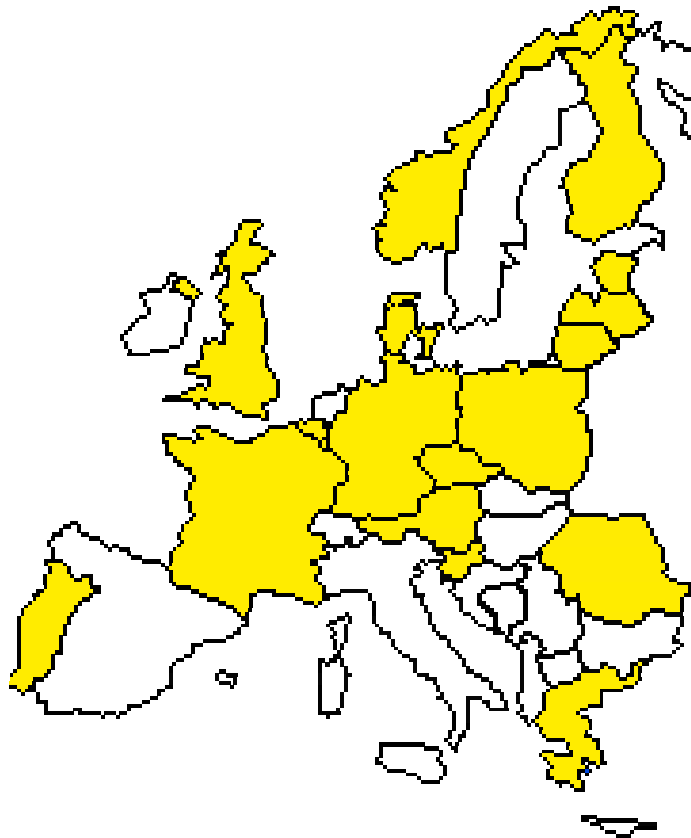


Figure 3 Other Activities with energy audits in the Member States, Norway and the CEECs

The level of information received from the total of 42 programmes varied a lot. Based on programmes from which reliable monitoring information was available, the cost-efficiency of the spent public money was calculated. At the lowest, an energy audit programme can result to savings at the cost of 0,18 cent/kWh. Equally in reduction of CO₂ emissions the cost can go down to 10 to 14 €/tnCO₂. These figures are based on the total cost and total savings generated during the lifetime of a long-run programme. Theoretically, the cost per kWh or per tnCO₂ will finally be much lower due to the fact that when a programme is terminated the savings will still be generated in the coming 4 to 6 years. During the first few years of a programme lifetime these figures will be significantly higher due to the upfront costs, typical for energy audit programmes. After 5 to 6 years from launching an energy audit programme can bring in reductions in CO₂ emissions at the cost of 6 to 8 €/tnCO₂.



The key to success is a well-defined goal. In order to give a good starting point for the development of the programme, the policy maker must define the goal for the activity in clear figures. Based on this goal a programme developer can estimate the needed resources both in financial figures and in number of personnel needed to operate the programme. The guidebook includes a concrete example on the planning process and on the limitations that might lead to either re-setting of the goals downwards - or the programme budget upwards.

An energy audit programme is built from total of 12 basic elements, each requiring first a rough planning on the principles and further on detail planning on the practical implementation. One group of three different basic elements is called the implementing instruments. The implementing instruments deal with the question of getting the energy audits started and reaching a sufficient energy audit volume. This question on “the driving force” is not only a technical question for the programme developer but can result in a political decision and further on changes in degrees or laws.

The goal setting is connected to the target sectors of the programme and the realistic penetration of energy audits, to average saving potentials and finally to the realistic realisation rate of the proposed measures. All these issues must be carefully analysed. In parallel with the overall shaping and sizing of the programme there is the question if this can be afforded.

When the major lines have been drawn the programme developer will have to design the administrative structure for the programme and decide e.g. on the groups of professionals that can fulfil the set goals, which normally means carrying out numerous high quality energy audits. Training of energy auditors, authorisation of the auditors, quality control, monitoring system and the marketing of energy audits – all separate issues that need to be planned and put into practice.

All 12 basic elements have several options the programme developer can choose from. Historically the programme developers have not had access to detail information on energy audit programmes but were forced to use the learning by doing method. This is one reason why some energy audit programmes have not been very successful in the past.

There is no such as a state-of-the-art energy audit programme. All existing programmes have pros and cons and compromises. But with today’s knowledge on the basic options and their interconnections, a programme developer has all it takes to develop a good energy audit programme - a cost-effective tool, which can significantly improve energy efficiency and reduce CO₂ emissions.



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Appendix 1	Summary of Programmes
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1 Background

Energy auditing is widely known all over the world with a long history in many countries. Still, it looks like most of the energy audit programmes have been built by using the “learning by doing” method, which is not the most efficient way of developing programme level activities. Development of energy audit activities has not been a systematic procedure in general. Examples exist on cases where the main problem has been that the programme developer has not really had sufficient expertise in the area. One reason to the re-inventing the wheel phenomena has clearly been the non-existing international co-operation. Although all programmes have national and local features, a lot of knowledge and experience would have been available.

Several organisations have today material on energy audits in their web sites. Search engines find nearly 40.000 hits with words “energy audit” and some 700 hits with words “energy audit program/programme”. At least one major international project has taken place. The outcome of this co-operation was a Source Book for Energy Auditors, published by the International Energy Agency in 1987.

The first comprehensive study on energy audit activities in the European Union was carried out in 1998–2000. The “AUDIT” project was co-financed by the SAVE II Programme and implemented by Motiva (Finland), IFE (Norway) and C.R.E.S. (Greece). One of the outcomes from the AUDIT project was the Country Reports on all 15 Member States and Norway, bringing in to the daylight over 50 different energy audit activities. From the theoretical viewpoint some similarities were found and e.g. a theory behind the different energy audit models used within the activities was developed. Also the way the energy audit activities were run in the countries provided information on the theory behind the structure and administration of energy audit programmes in general. The first international conference on energy audits, AUDIT’99, was arranged in the autumn of 1999 in parallel with the AUDIT project. The recommendations from the conference were realised in the summer of 2000, when the European Commission accepted a proposal on continuing with the work on energy audits (the AUDIT II project).

One finding from the terminated energy audit programmes has been that the programme itself might have been a success, but the termination had been due to a radical change in the government policy – or change of the government itself. Based on the results from the ongoing energy audit programmes the return of investment of public money spent on the programme is extremely good. Today the interest is in reduction GHG emissions. A good programme can after a few years bring the cost down to level of 6 to 8 €/tnCO₂. Due to the fact that a launched energy audit programme will create totally new and additional business, there will also be a return in taxes and possibly in unemployment costs as in Finland during 1992–1994. If this return of public money is taken into account, an energy audit programme can actually be not a cost but a profit maker. This would also mean that the price for the reduction of one ton of CO₂ is – negative.



2 Introduction to the Guidebook

The AUDIT II project has updated the information presented in the Country Reports of the previous AUDIT I study but broadened it to cover also the CEECs. The theories, which in practice means providing information on the various available options, cover five topics:

- Implementing instruments;
- Training, authorisation and quality control;
- Monitoring and evaluation;
- Energy audit models;
- Auditor's tools.

Finally, in order to ensure the continuity of co-operation in the area of energy auditing, a network for programme operators (the Operating Agents), and Administrators has been established.

The different means of introducing energy audits in the Member States lead to a need to define the type of the activity. All national energy audit activities have been divided into three following classes:

- Energy audit programmes (EAP);
- Other programmes related to energy audits (OP);
- Other activities related to energy audits (OA).

The difference between a programme and an activity is based on the existence of at least some of the so-called basic elements. A programme has administration, defined processes, schedule, budget etc. An activity is more open and informally run.

Between energy audit programmes and other programmes the division is not so clear. In a clean-cut energy audit programme the content of the work is the energy audit. There might be some supplementary aims included, but in an energy audit programme these are secondary aims. Often already the name of the programme includes words "energy audit".

Environmental programmes, where an energy audit is only a small part of the work, are a clear case of the other programmes. The type of programmes which are in the grey area are e.g. certification or labelling schemes, but this is more or less an academic question. If the "label" is based on an energy audit, meaning that the label itself is just a standardised or official way of presenting the information collected and analysed in the energy audit, the labelling scheme is categorised as an energy audit programme. If the label is produced without an energy audit, the scheme is totally outside the scope of the AUDIT II study. In general, if more than 90 % of the work is used to carry out the energy audit, the scheme is an energy audit programme. Finally, it has been up to the writer of the Country Report in concern to decide the category with programmes in the grey area, since it does not make such a big difference in the outcome.

In the following chapters the reader will find a thorough presentation on the basics on energy audit programmes. Although in some parts the touch may be slightly theoretical, nothing is invented without a strong link to a practical existing application in use in some country.



Chapter 3 is an introduction to the elements an energy audit programme is built from. The content and the meaning of the elements are presented briefly.

Chapter 4 deals with the goal, aim and focus, which are the starting point for the further planning and development of the energy audit programme.

Chapter 5 presents the key players which are needed in the programme and how these players and different operational actions can be connected into the programme administration.

Chapter 6 gives some principle ideas and example how the initial phase of planning can start, how the main lines are drawn and explains how the size of the programme affects to e.g. resources and how different programme features must be analysed and dimensioned.

Chapter 7 gives an overview on 9 basic elements:

- The different implementing options the policy maker has on the ways the energy audits can be launched;
- The options on training, authorisation and quality control;
- The options on the different levels for monitoring;
- The options on the energy audit models used within the programme;
- The various tools used in the programme to minimize the audit costs and maximise the audit quality.

Chapter 8 presents, with some examples, the evolution in the basic elements that will take place during the lifetime of the programme.

Notice:

All the information in this Guidebook has a strong link to actual existing energy audit programmes!



3 Establishing an Energy Audit Programme - the 12 Basic Elements

Theoretically an energy audit programme is built from 12 basic elements. On each of the elements the programme developer has numerous different options to choose from. Some of the elements are unavoidable in that sense that the programme developer cannot ignore the analysis of the options and has to make a decision. E.g. the key players have to be chosen otherwise the programme does not exist. It is possible to have a programme level activity without all 12 elements in place. E.g. an energy audit programme can be run without any specific “model” for the audit work. But it is another question how this, in practice “no models” option, will work and what kind of quality and results the programme will produce.

It is assumable that in many existing audit programmes some of these “no” options have not been a conscious decision. The analysis of the element has just been skipped because the existence and the effects of the element have not been understood. This is one reason why programme operators have a continuous need for restructuring or are forced to rapidly develop and put in place new guidelines. This rewriting the manuscript while the show is on is in practice analysing afterwards the options of the previously bypassed basic elements. Based on today’s knowledge on energy audit programmes a programme developer has an access to adequate information on which the whole planning process can be based on.

This chapter will present briefly the 12 basic elements of an energy audit programme to give a first glimpse on the key issues these elements are dealing with. The following chapters will go one step deeper in these issues. The comprehensive and detailed information on the options with references to actual experiences from ongoing energy audit programmes is presented in the Topic Reports. The 12 basic elements of an energy audit programme are shown in Figure 3.1.

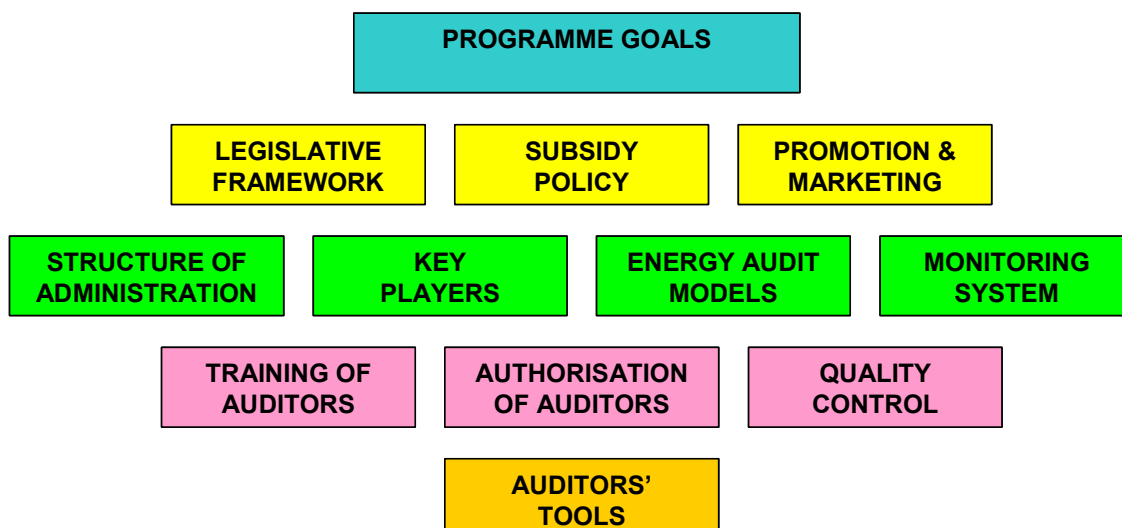


Figure 3.1 The 12 basic elements of an energy audit programme



Some basic elements can be discussed under the same heading. E.g. legislative framework, promotion and marketing and subsidy policy are all so called implementing instruments from the Administrator's viewpoint. All these elements can be used to support the same aim, which is to get the energy audits started and to achieve the set goal on the volumes. The main elements to ensure the quality of the energy audits are training, authorisation and quality control. Therefore these three elements have been presented in one topic report.

Some of the elements form pairs in the sense of a strong linkage. A decision in one element can limit or strongly direct the options available within the other element. E.g. the key players and structure of administration are tightly connected and furthermore, the key players is also connected to both training and authorisation.

Understanding and being able to utilise these interactions between the basic elements is a challenge for the programme developer. Everything affecting to everything requires an iterative approach. Some guidance can be given but mostly the connection and interactions are programme specific questions. The main point in the developing process is to understand that the basic elements are interconnected. The interconnection works both ways; one combination of chosen options in different basic elements can be poor choice in the sense of cost-effectiveness or effectiveness in general - but if well planned and implemented, some combinations can really support each other.

3.1 Programme Goals

Goals for an energy audit programme are normally given in numbers on annual and total energy audit volumes for sectors defined as target sectors for the activity. When the total coverage is defined there will also be question on the life-span of the activity. In parallel to the volumes alone the goals should determine also the intended concrete effects to be received from of an energy audit. A smaller volume of more detail energy audits might bring in better savings than a very light walk-through-type energy audit model in large numbers.

The set goals have a strong effect to total expenditure of the programme, to the manpower needed to both implement the audits and to co-ordinate the programme. The goal setting has an effect to most of the other 11 basic elements.

3.2 Legislative Framework

Energy audits may have a connection to the existing legislation even when the activity is based on a totally voluntary approach. The main question is whether the present legislation is in line with the planned programme in general. Changing the legislation is normally a slow process and needs to be really well based. If legislative changes need to be done, the programme developer has to know all those authorities that must agree on the changes. In some countries e.g. all kind of taxation related incentives might be a dead-end road from the beginning.

One concrete example on the legislative framework is a law or a degree the subsidies are based on. There might be some limitations on how these subsidies can be used. There can also be some specific requirements concerning the payments, acceptable expenditure e.g.



that need to be taken into account also in the energy audit programme. It is anyway better to analyse the situation in detail in advance than face possible problems when the programme is otherwise ready to be launched.

3.3 Promotion and Marketing

Whether the energy audits are initiated by voluntary or mandatory means there is always a need for promotion or marketing or both. The difference between promotion and marketing in this context is based on the aim of the activity. In promotion the aim is to maintain awareness and good publicity for energy auditing – not to sell individual projects. In marketing the aim is especially to sell projects to clients. The main idea of promotion is to support the marketing. It is easier to sell a project, which has been effectively promoted.

If energy auditing is voluntary, promotion and especially marketing are essential. In the voluntary approach an energy audit is like any other service product. It needs to be marketed to the clients – otherwise the product will not sell.

Promotional activities by a government organisation or a national energy agency can effectively support the marketing efforts of the energy auditors. Even when the energy audits are mandatory there is a need to raise the awareness among those organisations obligated to implement the audits.

3.4 Subsidy Policy

One option to support the energy audits is to use subsidies as an **implementing instrument**. If subsidies can be used, the adequate amount of subsidy needs to be estimate by target sector, taking into account the national conditions. The effect of the subsidy can be very sensitive to its level. Too small subsidy does not really activate the demand side but will only be picked up by those who would order an energy audit in any case. Too high subsidy percentage might reduce the cost-effectiveness of the programme. The commitment of the clients is dependent on the amount of money they are investing on the audits themselves. Free might not be valued. A clear fact is that the higher the subsidy, the higher the total cost of the programme.

The basic question is to find out the level where the trigger effect really starts. This level has to be evaluated separately in each of the chosen target sectors. The cost effectiveness of the programme is connected to the question of the subsidy level. In some sectors the trigger effect may start with a 30 % subsidy. On the other hand e.g. in the residential sector, the cost of an energy audit may be 3 to 4 times as high as what the building owners are willing to pay, which means that the level has to be 75 to 80 %. From the viewpoint of the cost-effectiveness of the programme the level of the percentage should be evaluated against the output of the programme - the generated savings per sector.

Subsidies are not involved only in voluntary programmes. If mandatory audits are introduced in the municipal or the residential sector, subsidies may be needed in some countries for social reasons in order to lighten the economical burden.



3.5 Key Players

An ongoing energy audit programme includes several tasks and responsibilities that can be connected to the existence of four different parties – the four **key players**. Two out of these key players are self-evident. **The Auditor** is needed to do the auditing work and **the Client** is needed to order it. The client (or clients) will be defined when the target sectors are being agreed on. The existence of the auditor is clear but depending on the chosen target sectors there may be several groups of professionals as options for playing the auditors' role – or just one group that can really do the job.

The other two players are called **the Administrator** and **the Operating Agent**. Without the Administrator there is no programme as the whole set-up is expected to be initiated by a government level body. The fourth player, the Operating Agent, is responsible for running the programme. Normally the Operating Agent is a neutral organisation working under the supervision of the Administrator.

There are naturally grey areas in the tasks, but for planning and development purposes this division into four players has proven to be useful.

3.6 Structure of Administration

An energy audit programme has several operational activities e.g. financing, reporting, monitoring, supervision (guidance) and marketing as well as concrete objects such as databases and help-desk services that need to be maintained somewhere. By using the four key players as the basic operators responsible for the specified tasks, the programme developer can plan the structure of the administration for the programme. Although there will be a lot of detail planning to be carried out later, developing the first general picture at an early stage is essential.

3.7 Monitoring and Evaluation

All energy audit programmes have some level of monitoring although the level the monitoring is implemented can vary a lot. Development and operation of a monitoring system can form the second highest area of expenditure of the programme. On the other hand, if there is not information available on the results, it will be difficult to justify the existence of the programme in the long run. A monitoring system in this sense can be a vital element of the programme.

The planning and development of a monitoring system is a long process and therefore should be started at an early stage of the programme. Monitoring is connected to the used energy audit models. The data available for the monitoring is the mainly the data, which is found in the energy audit reports. The more heterogeneous the reporting is the more laborious or even difficult will the monitoring become.

At some stage of the programme lifetime an evaluation should be carried out. The main aim of the evaluation is to see if the programme is running well and the set goals have or can be achieved. Evaluation is closely connected to the monitoring system in place. If the energy



audit programme in continuously monitored, there will be enough information available for the evaluators. And if the evaluation is well implemented, it can provide the Administrator and the Operating Agent with good suggestions on how to improve the programme.

3.8 Energy Audit Models

One fact that is not always understood is that different target sectors need different type energy audit models. E.g. a paper mill and a single-family house cannot be audited by using one standard model – or if done so, the guideline describing the model is so general that there isn't really anything to be called an audit model. From the theoretical viewpoint the type of an energy audit model can be either **scanning** or **analysing**. This basic option depends on the principle goal setting. Scanning models are used when the goal is to “point out” where there are opportunities to save energy. Analysing models are used when the goal is to “suggest” concrete energy saving measures. This difference between the models in relation to the goal setting is very important to understand.

The other issue to understand when deciding on the audit models is the different level of guidance required by the group of professionals chosen to work as auditors. A small group of skilled auditors can but also should be given more freedom to choose themselves what to do. A large heterogeneous group needs much more and detailed guidance.

3.9 Training of Energy Auditors

Some level of training exists in all energy audit programmes. The viewpoint given is that the Operating Agent has quite a few options to choose from. Although in principle a thorough training programme could produce super energy auditors, the reality sets several boundary conditions, which need to be taken into account. The Operating Agent needs to compromise between a comprehensive content and the maximum acceptable length of the training course for the trainees. The starting point for planning the training courses is the chosen key player, the energy auditor. What professional improvement is needed in relation to the chosen target sectors and to the chosen energy audit models?

The training of energy auditors is closely connected to two other basic elements, authorisation and quality control. The aim of all these three is equal – to ensure the quality of the audit work.

3.10 Authorisation of Energy Auditors

Authorisation can be defined as a licence, which enables auditors to operate within the programme but with two quite different aspects. Authorisation can either be restricted to those auditors only, that have unquestionable skills to do an energy audit or, it can be used as a mean to control the minimum performance of all energy auditors. The first option sets some clear demands to the Operating Agent – the indication of competence of the authorised



auditors must be very strict and continuously controlled. The second option is more to provide the Operating Agent a mechanism to pick out those auditors who finally do not have the capacity to perform properly.

The authorisation of energy auditors can be structured in several ways. It is clear that the performance of the auditors can be ensured if the authorisation is e.g. limited only to the area where the person in concern is really a professional. But likewise with the training scheme, a multi-level and multi-area authorisation can be very laborious to administrate. The Operating Agent needs to see that the complexity is in ratio with the realities, which are at least the available resources and the magnitude of the programme.

3.11 Quality Control

The importance of the quality control of energy auditing is for some reason not very well understood. It is not an uncommon comment that the quality issue is not really so important or that training and authorisation, not depending on how these are arranged, should be enough to ensure the quality. However, the effect of training and authorisation should not be overestimated.

The money invested in the audits both in subsidies and by the clients is not a minor sum. A share of 10 to 15 % of this money will be more or less totally wasted without quality control. This percentage represents easily the amount of poor quality audits, which are found by the quality controllers even in a smoothly running programme. Without quality controls' feedback these auditors will do the same mistakes in the next projects and might never learn how to do proper work. Quality control ensures that same mistakes are not repeated in the next reports.

The expenditure on quality control can easily be justified by estimating this direct loss and the secondary losses due to the totally or partly missed energy savings – the unfound opportunities. A good reputation of an energy audit programme is a necessity and the reputation can easily be lost even by a few poor audits only.

Quality control is tightly connected to training and authorisation. The common aim is to ensure the quality of energy audits and the main question is how to find a cost-effective combination of all three.

3.12 Auditors' Tools

One way the Operating Agent can improve the programme is to provide the energy auditors with tools that will have an effect to the quality and cost-effectiveness of their work. The selection of the different possible tools vary from printed marketing material to software for calculations and published key figures for rough first estimates on the level of energy efficiency of the building to be audited.

The tools are not for the auditors only; e.g. the reporting tools can significantly improve the Operating Agent's work and reduce the administration costs.



4 Programme Goals – Basic Element Number 1

4.1 The Aim and the Focus

The first question to be answered by the Administrator is the ultimate aim of the planned energy audit programme or scheme. The development phase is a long-term investment and the operation will require a reasonable amount of continuous financing. What is really wanted as an output? Today, in most of the cases the aim is coming from the need to reduce GHG emissions. Public money is no longer spent on activities where the money is not cost-effectively serving national interests.

An energy audit programme may also serve multiple aims. Improving energy efficiency, although probably the key issue is not necessarily the only aim. In countries where the residential sector cannot really afford to pay for the delivered heat and electricity, there can be a strong social feature involved. The new working opportunities provided by the energy audits can also make a difference in poor employment situation for many consulting and construction companies.

The higher up these aims can be led from the hierarchy of the national political statements, the more long-term commitment there will be for energy audits. At national level strategies define policies under which the programmes are used as tools of implementation. An energy audit programme itself is seldom very high in this hierarchy. The fact that the content and wording of these higher-level statements can be influenced is not always understood. The options the policy makers have in practice are not so numerous and a feasible suggestion like an energy audit programme might easily be accepted.

One part of the top-level decision-making is to analyse the legislative framework the programme is linked to. The legislation may bring some restrictions but also opportunities. The best understanding on this area is at the administrative level and therefore the Administrator of the energy audit programme should also take the responsibility on these necessary actions.

One part of the goal setting is the decision on the focus, e.g. on which forms of energy the activity is targeted on. The widest approach is that all energy consumption in all forms - including renewable energy sources - is included. Depending on the national priorities the activity can also be targeted e.g. to cover only electricity or fuel switches from oil to renewable energy sources etc. This more detailed goal setting has an effect to the required energy audit models and also on the professional background of the energy auditors – there is no need for mechanical engineers if the goal is set to electricity only.

4.2 Defining the Target Sectors

When a top-level decision has been made to start an energy audit scheme, the goal setting needs to be taken into a concrete level. The first step is to choose the target sector or sectors. One issue to be taken into account when considering the target sectors is the relation between the sector and the requirements for the features and properties for the program elements to be developed. The more heterogeneous a chosen sector is the more complex will also be the programme. The meaning of this complexity is that if an energy audit is considered as a



product, the product must be adjusted to fit the needs of the specific client group. In a heterogeneous target group one type of product will not fulfil the needs of all – and a compromise will probably not meet the needs of any.

Industry for an example is too large and heterogeneous to be treated as one single target group within the programme. There are major differences in many respects if the audit client is a process industry or a SME company. This kind of heterogeneity will have an effect on the required number of different energy audit models. And the more models there are in a programme the more variety there will also be in the other basic elements.

Choosing a very specific target sector can lead into a situation where the program developer might not be able to give any advice on the audit work. The energy sector can be an example on a target group where all the expertise might be in the hands of a very small group of auditors. This kind of a special sector needs a totally different approach e.g. in training and authorisation as well as in the energy audit models to be used.

The heterogeneity is a challenge especially to programme developers and Operating Agents but should really be understood by the Administrator also. With several target sectors one programme can easily become a group of several quite different sub-programmes.

4.3 Total Auditing Volumes

One top-level decision is the coverage by energy audits in the target sector. If only a few percent of the total building volume of a target sector can be covered during the planned length of the programme, the total effect will also be marginal. On the other hand if the aim is to receive a large coverage, the total number of audits e.g. in the residential sector, can be really huge.

Equally to the heterogeneity of the target sectors the consequences of these large audit volumes must be taken into account. The programme administration must be able to handle all the applications and reports within a reasonable period of time. The administration must also be able to maintain some level of monitoring and provide the market with adequate number of energy auditors.

The recommendation is to define on a detailed level both the sectors and the required or expected volumes, not only during the first year but also during the possible high peak years. The total amount of expenditure and work, needed to run the programme, will depend on the number and size of the target sector and the goals for annual and total auditing volumes. A detailed goal setting gives a better starting point for the further development of programme.

4.4 Start-up and Penetration

The set goals should be realistic. The start-up phase of a programme is always slow. It will take 2 to 4 years before the annual volumes are on such a level that some mentionable coverage can be expected. In order to be able to have adequate resources it is recommendable to estimate the growth in volumes and set targets by year for the whole length of the programme or at least for the first 3 to 5 years.



These targets for annual volumes will serve several meanings. It will be the basis e.g. for the required budget for subsidies. Running out of subsidy money in the middle of the year is one thing that the programme administration should try to avoid. This would create uncertainty in the market. The target setting is also the basis for promotional activities. Without annual targets, the whole programme is lacking a business-minded approach, which in many senses is the key to success.

One important thing is to understand that the first years will be spent on growing the “crop”. Monitoring data will slowly become available but for some time the samples are so small that the results are statistically unreliable. Depending on the project size and length of implementation of an average individual energy audit, it is possible that actual results can be seen only after the third or fourth year. The Administrator will have to be patient – the harvest time will come later.

4.5 Life-span of the Programme

The life-span issue is related to the budget-year planning cycle, which is an unavoidable feature in activities, which rely on financing from the state budget. The life-span of the programme is however a common and continuous concern for auditors and the clients. The programme will bring better results if both the auditors and the clients can plan all actions in line with their normal business planning cycles. A three to four year period could be considered long enough to form a stable environment for energy auditing. During this time also the changes in programme guidelines should be kept as small as possible. Annually changing guidelines are a problem not only for the auditors and the clients but also to any organisation responsible for co-ordinating the activity.

Although e.g. subsidies could be confirmed only on annual basis, the message should be clear that there is long-term commitment. It is better to define some year e.g. as a milestone than leave the termination year totally open. These milestones should be in line with possible mid-programme evaluations. The market will understand that the Administrator or the Operating Agent cannot guarantee that the subsidies will be there in the coming years – it is the publicly expressed commitment that is important.

An appropriate length for the programme is also in the interest of the Administrator and the Operating Agent. It is unrealistic to assume that there would be enough time and resources to develop all basic elements in such a way that the programme would be totally operational the day it is to be launched. The first one or two years can be considered as the start-up years. In any case there will be several small changes and adjustments are needed during the whole life span of the programme. Also the market itself is continuously changing and the programme has to be adjusted accordingly.

Based on the experience on the ongoing programmes the cost-efficiency of the invested public money increases with the length of the programme. This is the reason why the length of energy audit programmes should be reasonably long in comparison to what is normally expected from government run programmes. As an example the Finnish Energy Audit Programme has been running since 1992 and is today the oldest national energy efficiency grant scheme in place.



4.6 Free Riding and the Misuse of Subsidies

There is always a question on the free riding problem: how many audits would be carried out anyway and are the subsidies just taken because they are available? If there is an existing market for energy audits in a country this might be a real problem. But if the number of audits before launching the programme is very small, the free riding issue is more a theoretical question.

The other viewpoint is: how many audits would be carried out if a subsidy scheme were terminated? Some estimates have been given that even in a well operating programme the energy auditing volumes would drop 85 to 90 %. It is of course up to the Administrator to decide whether 90 % of the volume can be missed in order to avoid subsidizing this 10 % of the volume. With subsidies on investments the free riding problem must be taken seriously but with energy audits it really isn't a big issue.

The more serious problem and a challenge to the quality control is the misuse of subsidies on projects that are not energy audits but other kind of studies or design projects. Some clients and auditors might find it tempting to try to mask other work as energy audits just in order to be subsidized for it. The two most common project types that are being tried are feasibility studies and condition assessments. Feasibility studies often have a small element concentrating in energy efficiency or energy costs and therefore e.g. in industry it might be difficult to separate from real energy audits. Condition assessments are uncovered by the proposals written into the report. If the work has been a condition assessment, majority of the proposed measures concentrate on technical improvements and all energy savings are on a very general level.

In the start-up phase of an energy audit programme when neither the auditors nor the clients have a clear understanding on the content and on the aim of an energy audit, these cases can be just a matter of misunderstanding, not really an attempt to misuse the subsidies.

In general the problem with the misuse of subsidies is very small if the guidelines for energy auditing and on the energy audit models are detailed and clear. A good quality control process is naturally the only way of locating these masked projects and also ensuring that all such reports will be rejected.

Notice:

Well-defined programme goals are the key to successful implementation.



5 Key Players and Structure of Programme Administration – Basic Elements Number 5 and 6.

The introduction on the four **key players** (Figure 5.1) as four separate organisational levels does not mean that a programme could not, if resources are available, be made to work with two or three different levels. This is more a question on the desired administrative structure of the programme. By using four separate organisational levels as a basic option it is easier to present division of tasks and responsibilities. The key players and programme administration are two basic elements, which are very closely connected and need to be planned simultaneously.

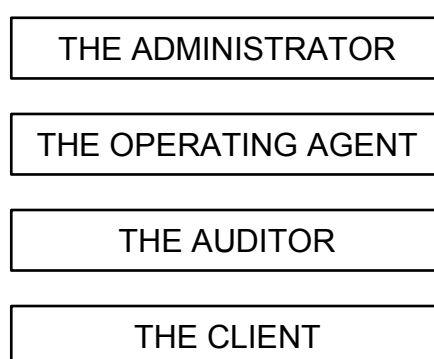


Figure 5.1 The four key players

5.1 The Administrator

The Administrator is always the policy maker but not necessary the body to implement the policy at a practical level. This idea of presenting the Administrator and the Operating Agent as two separate players is coming from the trend that government level organisations don't normally have resources to operate programme level activities. This trend has also been one reason why energy agency type of organisations have been established.

The Administrator and the Operating Agent are the two key players between whom the division of responsibilities is more a question of convenience in the respect of capability of carrying out the tasks. In principle it is up to the Administrator to decide how the responsibilities are shared. In some countries the Operating Agent can handle public money e.g. take care of the subsidy applications and payments whereas in some countries this is not possible. But the more tasks are divided between the Administrator and the Operating Agent, the better co-operation is needed between these players.



5.2 The Operating Agent

In many countries there are existing organisations that could take care of those responsibilities that the Administrator is either not capable or for other reasons not willing to take. These organisations are naturally the first options because setting up a new organisation just for the energy audit programme might not be very realistic. However, there are some requirements that need to be taken into account when the organisation for the Operating Agent's role is being chosen.

One question is the neutrality of the Operating Agent. If public money is involved, the Operating Agent should be free of all connections that might endanger free competition. If the Operating Agent is somehow competing with the energy auditors there is a clear case of conflict of interest. In this sense the Operating Agent should not be involved in the energy auditing business itself.

Another related question is confidentiality. Depending on the target sectors some of the information collected and filed into the monitoring system can be very sensitive. At least in voluntary programmes it is out of the question that clients give this information to an organisation, which is not officially restricted to use it commercially or to distribute it further without a written approval by the clients. E.g. in industry it is not uncommon that the auditors have to sign an agreement on the confidentiality on all received information.

The Operating Agent should either have or be able to recruit adequate professional expertise. In principle it is possible that a part of the Operating Agent's tasks are outsourced. The neutrality and confidentiality problem does not vanish by subcontracting. Some areas (e.g. training) are easier to subcontract whereas in some areas (e.g. the quality control of energy audits especially in sectors like industry) are very difficult in that sense. To some extent it is possible to divide the tasks between the Administrator and the Operating Agent according to the sensitivity criteria. But as the principle idea of having a separate Operating Agent is coming from the lack of resources in the Administrator's organisation a division based purely on the sensitive and the non-sensitive tasks is not very realistic.

One experience has been that the more tasks the Operating Agent is given, the more professional the Operating Agent will become in running and developing the programme. Another experience is that the Operating Agent should employ at least one person with prior experience on the energy auditing work. Pure academic knowledge is not a good starting point for the necessary co-operation with the auditors. Energy auditing is quite demanding and practical work - a very special area in many sense.

The Operating Agent will be involved in most of the basic elements, either directly responsible for the operation e.g. maintaining the monitoring system or supervising the work e.g. when the energy audit models are being developed. The needed resources as well as the needed in-house expertise can be estimated in parallel to the planning process of the programme.

One recommendation is to involve the Operating Agent in the earliest possible stage of the programme planning and give the Operating Agent as much responsibility as possible on the planning, especially on the practical arrangements. It is assumable that the Administrator is not very close to the clients and auditors. In this area the Operating Agent's existing or recruited experience can be extremely valuable to be able to develop a programme, which is in line with the normal daily life of the market place.



5.3 The Auditors

Because the auditors are critical players for the programme they should be really chosen by the Administrator or the Operating Agent. In all countries the selection from which the energy auditors can be chosen from is wide. There are, however, a few points that need to be analysed when decisions are being made.

The first question is the number of different professional groups and number of professionals in the group. Depending on the chosen target sectors and energy audit models, the different professional groups have different existing capabilities to perform within the programme – to carry out good energy audits. Expertise on energy issues in general is not enough. The output from an energy audit depends more or less totally on the auditors' capability to perform in the fieldwork. To some extent these capabilities can be improved by training but there is a limit on how much improvement can be achieved by a reasonable amount of training. As an example a list of different professional groups, based on the background of the employer could as following:

- Consulting companies divided into subgroups by area of consultancy;
- Utilities;
- Research institutes and universities;
- Manufacturing companies;
- Construction companies;
- Branch associations.

Each professional group should continue the analysis on the following issues:

- The existing professional expertise in the group with reference to the intended content of the energy audit work;
- The areas where a need for training exists as well as the amount or the depth of the required training;
- The availability of adequate number of potential auditors from the groups.

In addition to these technical and quantity questions there are a few other viewpoints that should be evaluated. One is the ability to contact clients and market the energy audits. If the auditor does not "know" the clients and their way of decision making, it will be difficult to sell the energy audits. Another viewpoint is the ability to assist the clients in the implementation phase after the energy audit report has been completed. As the aim is reduction in energy consumption the programme will not be very effective if the service provided by the auditors is limited to the energy audit only.

The thoroughness of this analysis depends on the chosen target sectors and on the dimension and life span of the intended activity. With several target sectors the suitability of different professional groups can vary. The more homogenous and technically simple the target sector is, the wider is the available selection of auditor groups for the Operating Agent to choose from. With a narrow target sector, especially if it requires special expertise e.g. in power plants, the options can be very limited.

The selection process of the energy auditors is tightly connected to training, as pointed out earlier, but also to the authorisation and quality control. The Operating Agent should not overestimate the effects of training. Especially the basic education of an energy auditor is



unavoidably something that just has to be accepted – e.g. mechanical engineers in general cannot be used if electrical systems need to be audited. On the other hand, a top class process specialist might totally out of line with in principle technically simple ventilation systems.

5.4 The Client

The Administrator chose the clients when the target sectors were defined. A client is naturally needed to order the audit and pay for the work. One problem with the clients from the Administrator's viewpoint can be that the Administrator does not really know the client. Although goals have been set for the programme, these goals will not be met if the general set-up is not in line with the clients' thinking and decision making. Especially in a voluntary programme it is extremely important to have a business minded approach. All bureaucracy must be kept at minimum and guidelines as transparent as possible. This might be something totally different to what the Administrator is used to. But there is no option – the clients' needs must be taken into account. The best option is if the chosen auditors know the clients well. Then there won't be serious problems in the marketing of the energy audits and the both the Administrator and the Operating Agent can concentrate on their key player roles.

5.5 Programme Administration

The programme administration is a basic element where the main principles can be drawn quite rapidly. It will be another question to plan the working processes in detail. The General Model for Energy Audit Programme (figure 5.2) is a useful modelling tool to start the planning of the programme administration.

The four key players are at this point illustrating the different roles that are needed in the programme. The next step is to divide the responsibilities of different tasks between the key players. Some of the tasks are self-evident but with some tasks the programme developer has a few options. One example on the division of the responsibilities is the following:

- The Administrator: overall supervision, guidance of the Operating Agent, financing the audits (subsidies), financing the Operating Agent's work;
- The Operating Agent: training, authorisation, quality control, monitoring, reporting to the Administrator, guidance of the auditors, promotion;
- The Auditor: the energy audit work, marketing of the energy audits, assistance to the clients in all paper work;
- The Client: financing of the audits (at some percentage), reporting to the Operating Agent, partial quality control.



Even if the division of some of the tasks might first sound self-evident, the reality is that the programme developer has quite a few different options to choose from. Depending on the way the players are placed into the model – 2, 3 or 4 different boxes (Figure 5.3) – the programme developer can draw lines describing the following actions:

- Financing;
- Promotion;
- Reporting;
- Guidance.

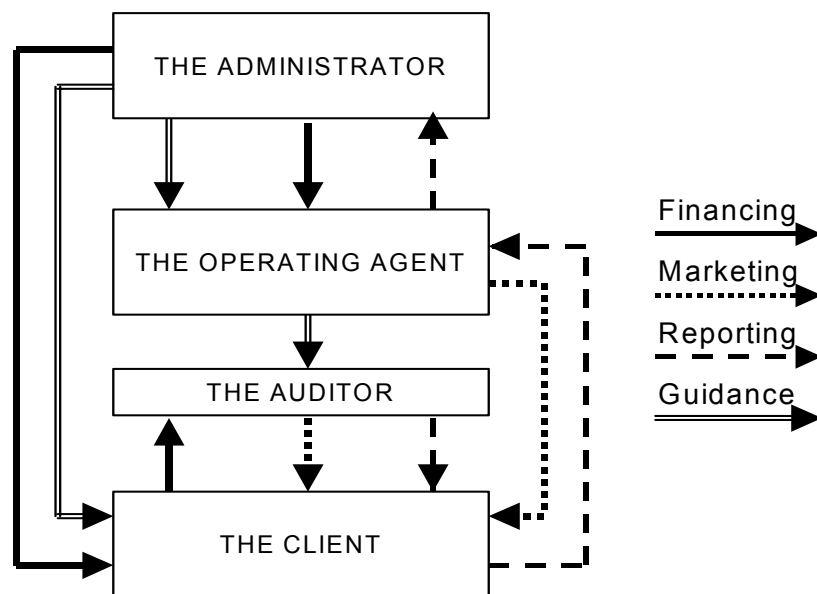


Figure 5.2 The General Model for an energy audit programme

In parallel with the planning of actions, the programme developer will have to decide how many different players at the organisational level there actually will be in the programme (Figure 5.3). Although figure 5.2 with four different players is considered as the basic option on which the further modelling is based on, there are both advantages and disadvantages in all the presented four options. All energy audit programme found in the Member States can be modelled and illustrated by using this general model.

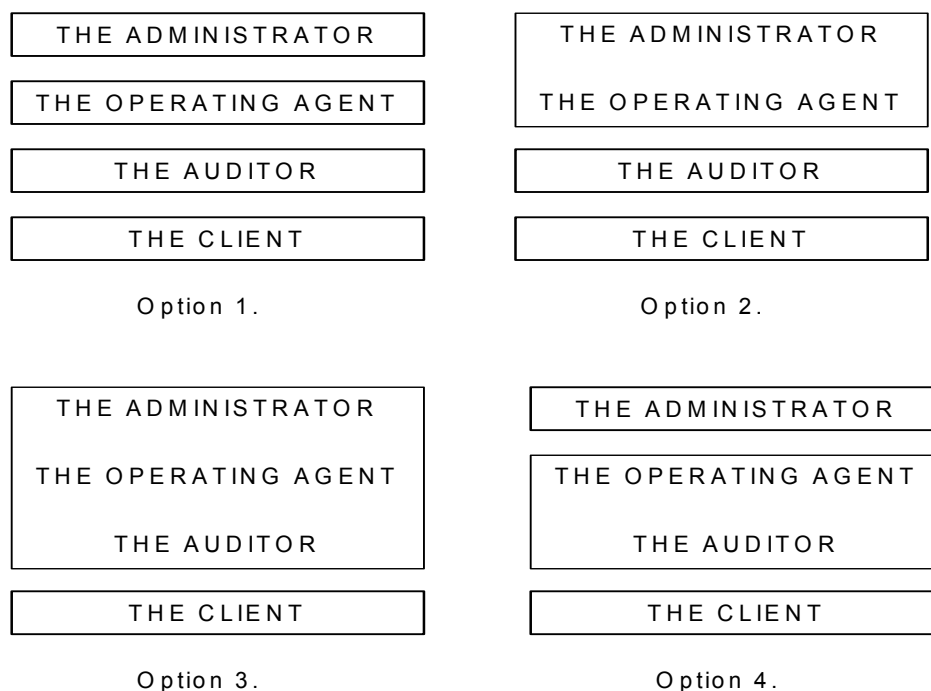


Figure 5.3 The four options for the four key players

In option 1 the responsibilities and tasks are divided between four different key players (Finland's Energy Audit Programme 1993–). In option 2 there is no separate organisation to run the programme but the Administrator is taking care of all administrative and operative responsibilities (France, Decision Making Scheme 1999–). There are no major differences between these two options. The first one fits better in countries where the responsibility for planning and launching programmes is at the ministry level but the ministry level is light in personnel resources and all operational work is normally outsourced or subcontracted. The second option fits better in countries where in general the responsibility and authority for planning, implementing and operating energy efficiency programmes is given to a national non-governmental organisation. In the second option this organisation must be quite strong both with staff and financial resources (e.g. Ademe in France).

In option 3 also the energy auditors are part of one organisation (Ontario, Canada, IESP 1987–94). With this option there is no need for either authorisation of the auditors or real guidelines. With only two organisations involved and one organisation taking care of Administrator's, Operating Agent's and auditors' tasks, the whole programme administration can be really light. Problems will come with the energy audit volumes. It is not realistic to employ a large number of auditors especially in a government organisation. In this sense option 3 can be seen as a special case.

In option 4 the organisation responsible for running the programme is carrying out the energy audits (Belgium, Utility Energy Audits). This option is getting very close to commercial audit programmes. It is however possible that the total responsibility for a programme is mandated by a government level body. E.g. DSM type energy audit programmes could be administrated by this option.



When the number of different players has been decided, the planning goes further into a detail level. Figure 5.2 is a good simplified illustration presenting the general principles, but most of the tasks need to be divided into subtasks before the basic element is really operational. E.g. reporting will unavoidably take place between more than two players. When the reporting process is planned in detail, there is a need for a separate specification e.g. a process flow chart. In order to make the reporting work, the planning of this process must be very detail.

Figure 5.4 is one example how e.g. the financing of the Operating Agent's work can be arranged. Operating Agent's work is only one part of the financing of the programme. In this example the Operating Agent tasks are financed from different sources. The responsibility to cover the costs is put to the key player who benefits from the work or creates the need for the it. The Administrator is in this case responsible only for costs connected to the overall responsibility of the programme.

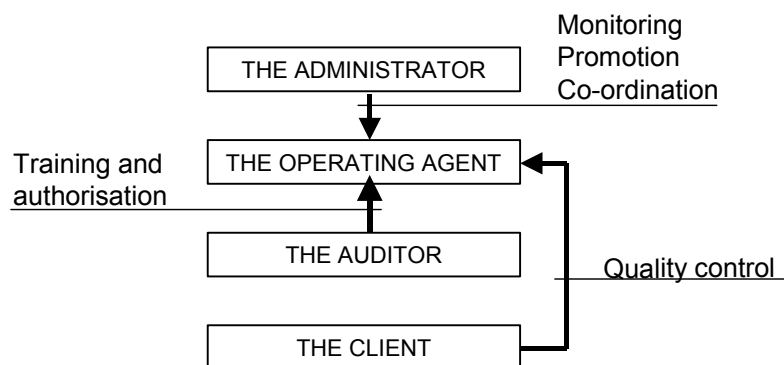


Figure 5.4 Financing the Operating Agent's costs

But before any detailed planning can take place, the general lines must be drawn. In addition to the action lines the programme developer can plan the maintaining of databases, help desk services etc. The responsibilities for these tasks must also be decided and adequate resources allocated.

It is difficult to give advice on good or poor approaches concerning the programme administration. More or less all options have been tried and some examples can be found from the Country Reports. One experience is that the better the programme administration is planned and the more detailed descriptions exist on the administration procedures, the less unexpected surprises will take place when running the programme.

Notice:

The programme developer might be forced to compromises but these should always be based on conscious decisions. The Operating Agent must know and understand in which areas the programme is not built in the best way and what kind of side effects these compromises might create.



6 Examples on the Start-up Phase – Programme Developer's Challenges

Chapter 3 presented the 12 basic elements as separate elements without any hierarchy or interconnections. In practice these basic elements form groups and some are tightly connected. There is also a hierarchy between the elements. Figure 6.1 shows the interconnection between one basic element, the key players, and other grouped or individual basic elements.

Programme “goals” and “implementing instruments” are usually decided and applied on the administrative level. While “training, authorisation and quality control” are mainly developed and applied by the Operating Agent to control the auditors, “tools” and “models” are mostly developed by the Operating Agents (in co-operation with the auditors) but are applied mainly by the auditors during the auditing of the clients. “Monitoring” on the other hand is relevant for all key players: the Administrator needs the results to justify the programme, the Operating Agent keeps track of the monitoring and auditors and clients provide the data to be monitored.

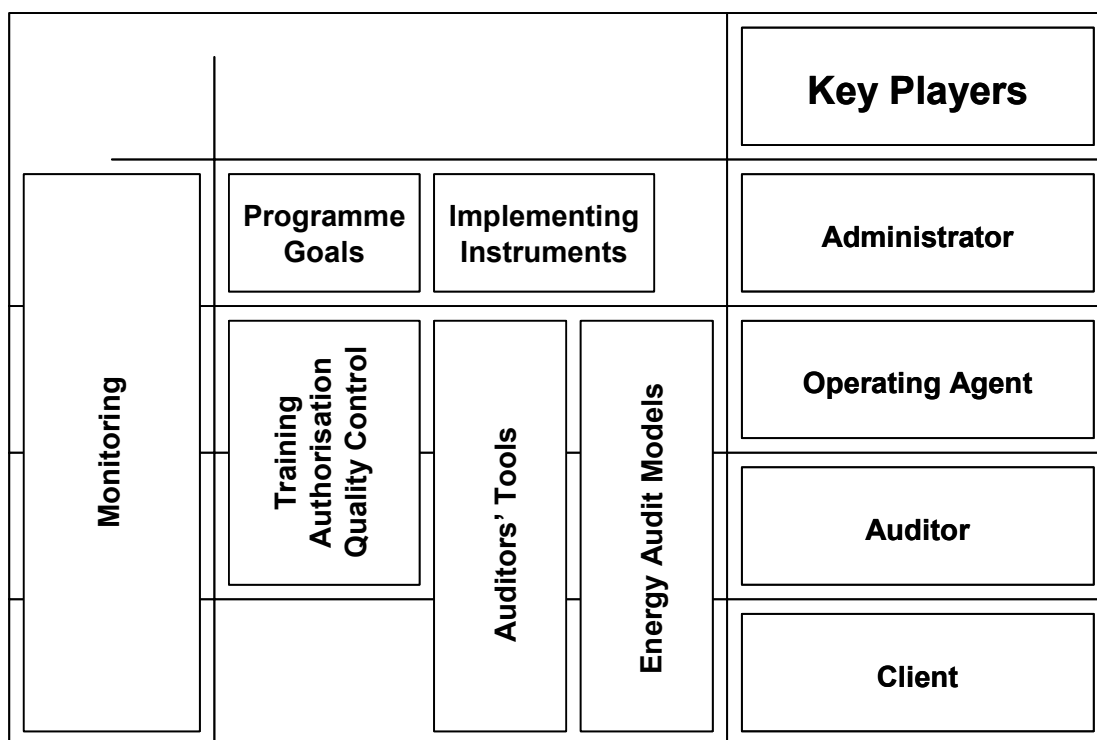


Figure 6.1 Interconnection between key players and the other basic elements



6.1 Choosing the Target Sector - Case Industry

Figure 6.2 presents a flow chart how an energy audit programme for the industrial sector can be developed. A common way to start an energy audit type of programme for the industrial sector is to start defining the goals. As a first step it is suggested to set quantitative targets e.g. to reduce 1 Mio tn CO₂/a, to carry out 100 audits per year and/or to cover 70 % of industrial energy consumption by audits etc. Energy audit programmes, which have only qualitative targets, e.g. increase energy efficiency, realise cost-effective measures etc, are rather difficult to evaluate.

In case a quantitative goal already exists or is demanded within the policy framework e.g. through a climate strategy, via the Kyoto protocol etc, the next step for the decision maker or the programme designer is to find out which target group of the targeted sector is able to fulfil this target. In this example the target sector is industry. If the policy framework does not specify quantitative targets the programme developer or the policy maker should set them. Then the target can be specified and re-calculated after the target group is chosen.

In general industry as a target group can be divided into energy intensive industry and less energy intensive industry. Another division is big industry and SME, because SMEs are often considered to be less energy intensive. This is often the case but it needs not to be. The characteristics of big industries or enterprises and of SMEs are mostly very different. SMEs are rather homogenous, less energy intensive, and the energy efficiency measures applied are not too complicated covering rather cross cutting measures (heating, cooling, lighting, motors, transport etc). In contrast, big industry can be very energy intensive. Big industrial sites are often heterogeneous. Processes are difficult to compare and measures need often to be tailor-made for each company. The programme developer has to take all these aspects into account. As explained later, the decision on the target group influences several other features of an energy audit programme.

One reason to decide to go for energy intensive industry might be that the target can be fulfilled by applying less but rather comprehensive audits. SMEs can still have higher energy efficiency potentials compared to energy intensive industries but in order to achieve a certain absolute target a bigger amount of audits has to be carried out. So the absolute amount of savings (the goal) can already limit the leeway when choosing the target group. National Statistics is a good source for information on the division of energy use in industry.

Confidentiality reasons but also the amount of firms to be audited have to be taken into account, as well as how easy it is to compare the firms (e.g. for benchmarking).

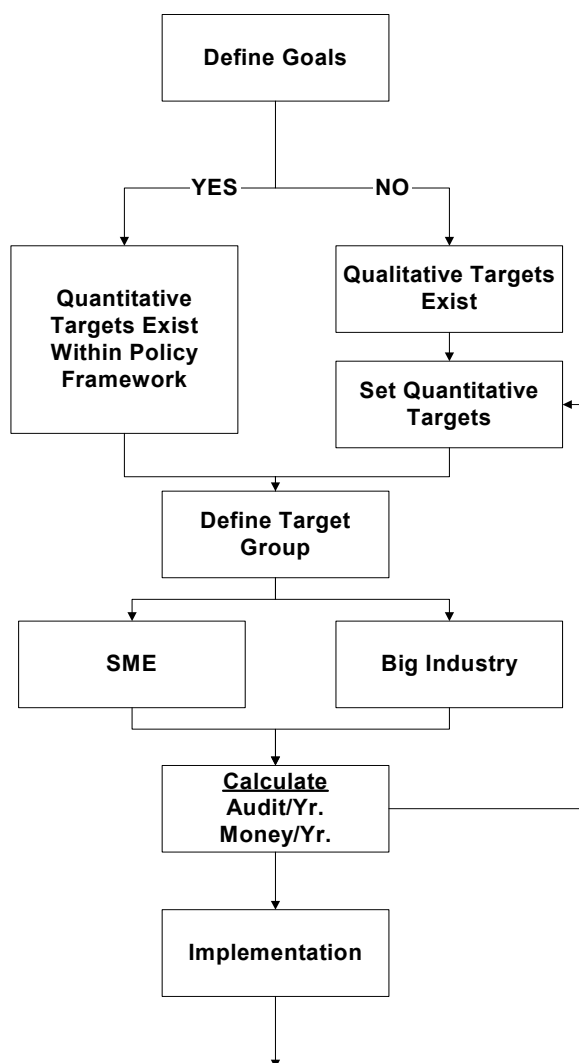
If SMEs are chosen to be the target group/client e.g. because they are politically more important, then an energy audit programme developer can start making first calculations. The calculations will show how many audits per year have to be carried out and how much money is necessary in order to make SMEs realise the measures. The need for public money depends on the level of subsidies e.g. 30 % audits and 10 % for investments.

If much more than 100 audits per year have to be realised then an audit programme developer should estimate if this huge amount of audits could be handled by the Operating Agent as well as by the auditors. The consequence might be that a strong auditors network has to be installed. This will have an effect on training, quality control but also standard tools to be developed. After deciding which are the branches to start with, it has to be taken into account that the clients have to get motivated in order to undertake an audit. But to motivate such a big number of SMEs every year might be only possible if certain multipliers such as the



chamber of commerce or branch associations get involved, which might have effects on the structure of the administration of the audit programme.

Another possible issue can be limited financial resources. This might lead to the involvement of key actors, which were not yet planned to involve from the beginning. These sources can be regions, funds, energy utilities etc.



Issues to be considered:

Quantitative targets should exist, otherwise an EAP is difficult to evaluate

The chosen target can already limit the choice for the target group

SME and big industry have can have very different characteristics. Issues are: Confidentiality, comparability, amount of firms within the target group, etc.

The amount of audits per year or the amount of money spent influences which parties are involved at the administrative level

> 100 audits/a
(need for strong auditors network)

Figure 6.2

Case: Industry – flow chart how to design an energy audit programme

Notice:

Be aware that the choice made with the target groups will influence several basic elements.



6.2 Dimensioning the Energy Audit Programme

One issue, which is related to the comprehensiveness of a programme, is the size of the programme. Some programmes might not have all possible elements in place or the elements are lightly applied due to the size of the programme. This can be justified realism and based on the quite heavy up-front development cost typical for energy audit programmes.

It is thus necessary to assess correctly by advance the various quantitative elements entering the programme: number of audits, number of auditors, amount of financial support for subsidies, cost for tools or training, structure and cost for quality control, organisation and cost of monitoring and evaluation - for which all, the key figure is more or less the number of audits per year.

One way to scale the programmes is to define that if a small country is running a small programme, the programme is obviously small by all standards. This means that there are less than maybe 100 energy audits per year. A medium-size programme would be a nation wide programme run in a small country or a restricted programme run in a big country, which means 100 to 1000 energy audits per year. And a large programme is correspondingly a nation-wide programme in a big country with over 1000 energy audits per year.

The dimensioning is not a one-sided issue but also related to the size of the individual energy audit projects. One hundred detailed energy audits per year in the process industry has naturally more magnitude in many respects than 1000 walk-through audits of single-family houses in the residential sector.

The essential initial step is to be able to base the programme on objectives (the goals) and then to relate them to some market figures.

The objectives usually result from some political decision and/or international set of goals: for example in EU countries, GHG emissions reductions commitment set a percentage of reduction of energy consumption in each country and this objective is then frequently declined, on a national or regional basis, according to each sector of the economy

Normally an audit programme Administrator should know the relevant market figures: size or number of enterprises, energy consumption etc.

The organisation in charge of developing the programme will then have to carry on one or several iterations (Figure 6.4) to find the operational goals that meet the policy objectives whereas respecting the constraints and or limitations due to budget availability, auditor's capacity or Operating Agent capabilities to handle the programme.

Depending on the nature of the programme (mandatory/voluntary), the level of subsidy (if any) and the allocated budget or the life span, not all parameters can be changed. In this development process some hypothesis - either based on previous experiences or field-testing - will need to be put forward:

- The penetration rate of audits, even when compulsory, or as a function of the level of subsidies as in the theoretical graph underneath;
- The efficiency of audits as "energy saving instrument". This efficiency is depending on the audit model itself (detailed/versus simplified), on the audited premises, on the quality of the study, etc.

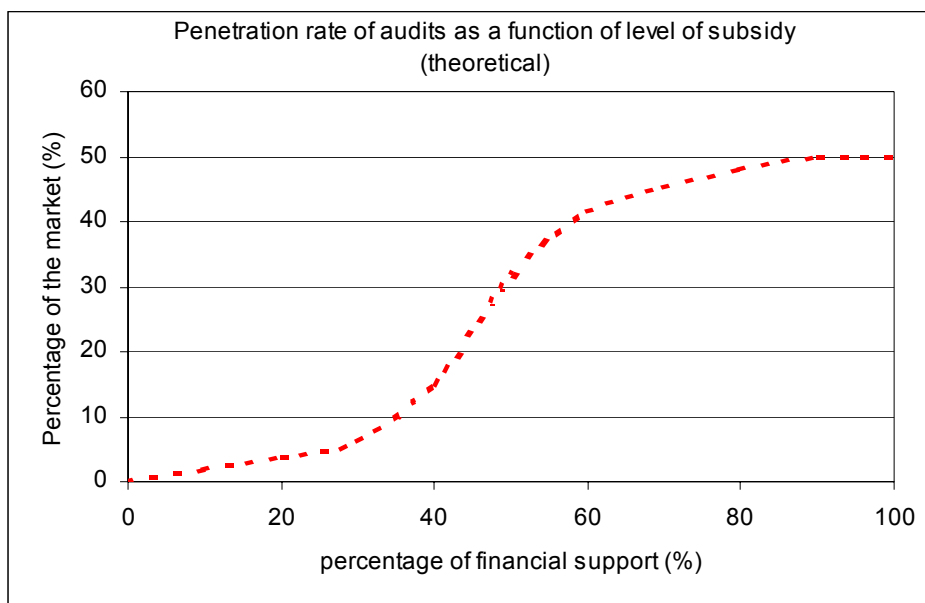


Figure 6.3 Assessing market penetration depending on incentives



Figure 6.4 indicates some of the steps to be taken into consideration when dimensioning the scheme.

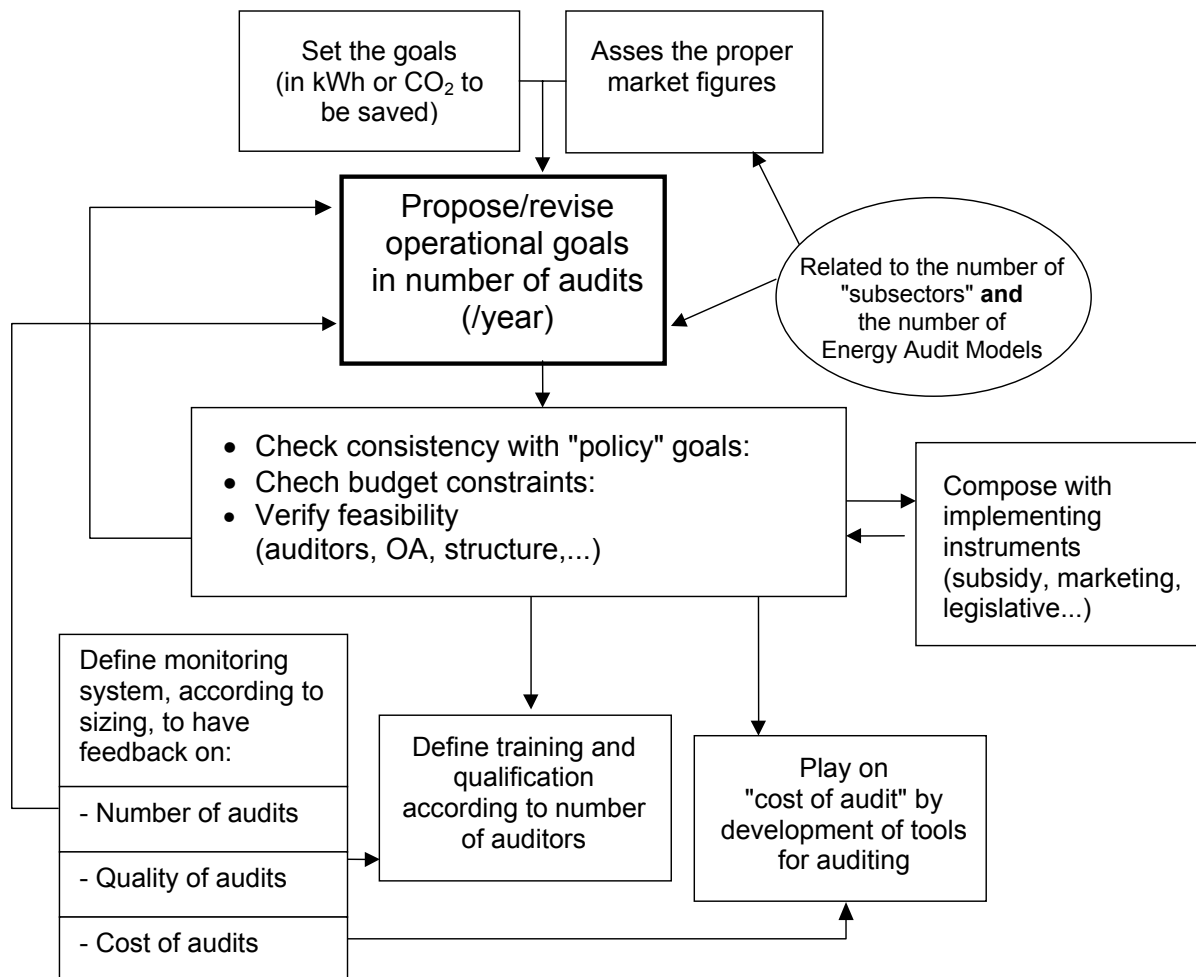


Figure 6.4 Flow path for dimensioning of the operational goals and related issues

The dimension of the programme has an effect on the required resources. In principle the needed work can be divided into development and operational work. Another viewpoint is to divide the costs into fixed costs, which are not so much depending on the dimension of the programme and to variable costs, which are related to the number and size of the energy audits.

One general recommendation could be that if the programme will be small, the programme developer should be more cautious on the intended comprehensiveness and how much development or fixed costs can be afforded. But in any case the set goals for annual and total volumes will give a lot of background information for the programme developer in the planning phase as well as to the Operating Agent in the operation phase.



When comparing the development and operation of a programme in a small country in comparison to a big country one difference is the possibility to manage the programme at more personal level. In a small country the number of energy auditors or at least companies working in the field can be reasonably small and the Operating Agent may even know most of them. This can also be achieved if the Operating Agents tasks are handled regionally.

Notice:

In a small programme comprehensiveness can easily lead to poor cost-effectiveness.

6.3 Limitations in Dimensioning the Programme

When the developer comes to evaluating what the "operational goals" in the energy audit programme are, he needs to ensure that those are not contradictory with some features of the whole scheme. Evidently, in a voluntary scheme, he will make sure that the support allotted to the audit clients does not exceed the available budget. But other inconsistencies must also be taken care of. These are illustrated through the following two examples: the first deals with a voluntary programme in the building sector, the other with a mandatory/compulsory programme where another aspect than financing has to be dealt with.

6.4 Example of Limitations – Case: Voluntary Scheme

The parameters introduced at the developing stage are presented in figure 6.5.

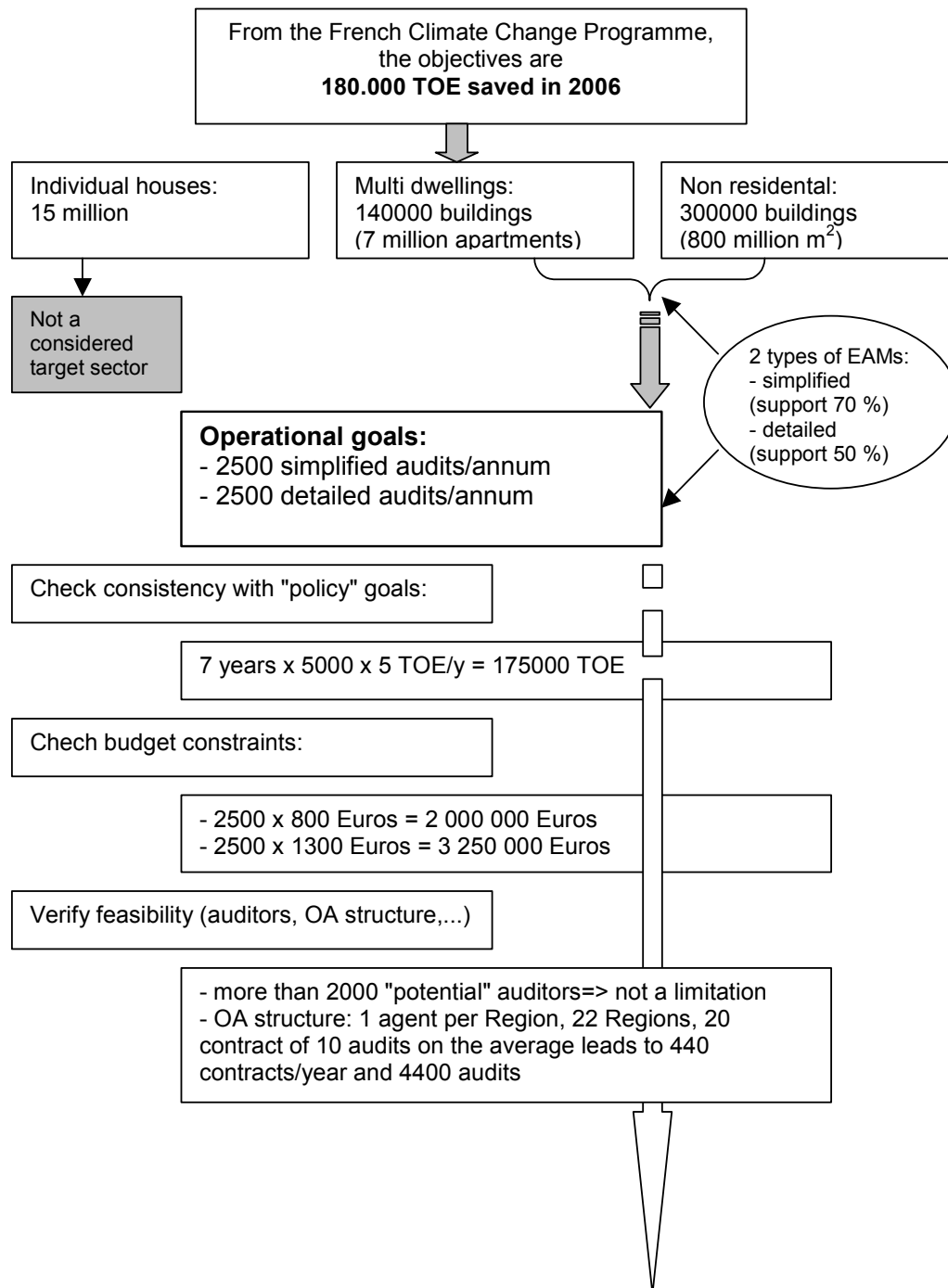


Figure 6.5 An example of parameters affecting the development stage



The target sectors are limited to multi family dwellings and non-residential buildings. It is impossible to cope with the large number of individual houses and respect the budget constraints. It would suppose an operational goal of 25.000 to 30.000 houses per year. Considering an average support of 300 €/house, this would lead to a budget - only for financial support - between 7.5 and 9 M€, whereas the allocated total budget in this sector for this operation is 6.1 M€.

- With the operational goal of 5000 audited buildings, the resources for funding are evaluated up to 5.25 M€ which is consistent with the total budget. There are other financial needs such as marketing activities, monitoring & evaluation, tools development and dissemination, training etc;
- With an average of 5 TOE saved per audited, the programme, over its 7 years duration (2000–2006) should generate approximately 175.000 TOE energy saving/year which is consistent with the policy goal building. Data on savings is based on previous evaluations including implementation rate of recommendations as well as average consumption of buildings;
- There is no particular limitation due to the number of auditors. Although all consultants cannot be considered from the beginning of the scheme as operational auditors, it is evident that the operational goal of 5000 audited buildings/year does not require much more than 200 to 300 auditors. This can be easily found among the professionals;
- In this example, the only actual limitation comes from the Operating Agent itself. The operating cannot make available enough staff to reach higher operational goals. This limitation in the number of contracts and/or audits that an agent is capable to handle in a year is connected to other dispositions;
- The quality control system as well as the marketing of the scheme relies for the most part on the Operating Agent staff;
- The implementation rate of energy saving measures is strongly related to the involvement of the Operating Agent staff in a voluntary scheme. In this case the price for a rather high implementation rate is a reduced number of contracts handled per year.

The audit volumes of the programme, which was launched last term of 1999 are presented in the table below.

	1999	2000	2001	2002
Number of contracts	117	353	449	677
Number of audited buildings	846	5067	3090	8078
Audit funding (M€)	2.0	3.6	2.2	4.9

Considering this activity level at mid term of the programme, it seems that the objectives should be met and the initial assumptions are more or less confirmed.



6.5 Example of Limitations – Case: Mandatory Scheme

When energy auditing is made mandatory through a legislative framework, it does not mean that no other developments are needed. In practice, although there are no particular constraints regarding the financial aspects, there might still be obstacles to a correct penetration rate of the measure.

One major limitation may be the availability in auditors: when an audit is made compulsory, the rules define generally the periodicity within which the audit must be conducted and re-conducted. The application of this gives operational goals in terms of number of audits to be realised in a year: if the periodicity of the audit is 5 years, then at least one fifth of the target sector stock needs to be audited every year. This activity must be balanced over an adequate number of auditors.

If the developer has not checked this aspect and/or envisaged corresponding activities in terms of training and qualification of auditors (and also development of tools), it will be one major reason why the programme is not successful.



7 Topic Report R sum s

– Basic Elements Number 2 to 4 and 7 to 12

The following chapters are summaries of the Topic Reports dealing with 9 different basic elements. The implementing instruments is a group of three basic elements: legislative framework, subsidy policy and promotion and marketing. Training, authorisation and quality control is another 3-element group. Energy audit models and auditor's tools are single-elements. Figure 7.1 illustrates the areas presented in the following chapters.

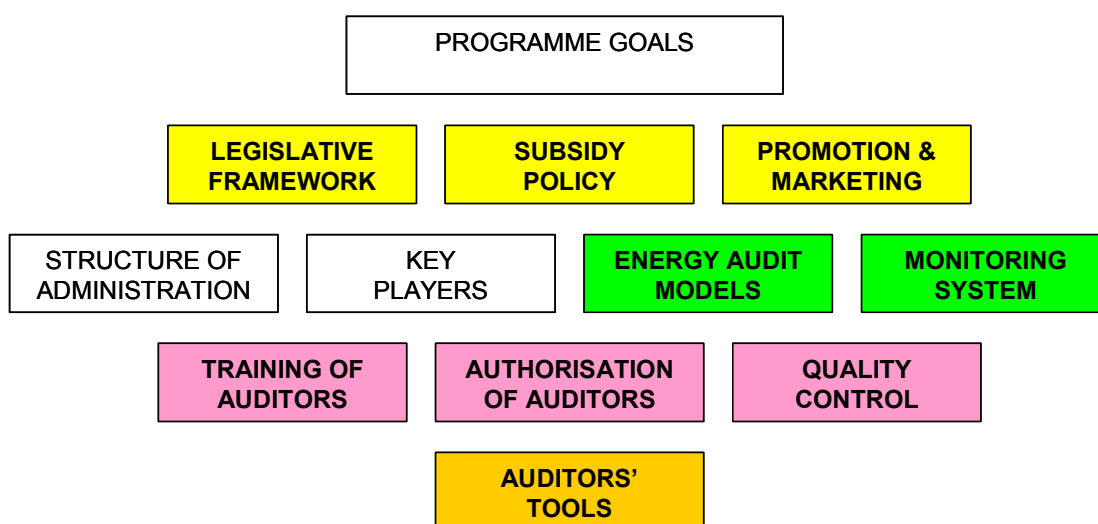


Figure 7.1 The 12 basic elements of an energy audit programme

7.1 The Implementing Instruments

7.1.1 Introduction

Increasing energy efficiency is much a matter of how to reach a target group and how to convince it to act (i.e. to carry out an energy audit). Different implementing instruments can be useful to achieve this task, however, before choosing a certain type of implementing instrument a policy maker needs detailed information about the target group that should be addressed. Is the target group homogenous (e.g. tenants, energy extensive SME, certain types of buildings) or is it very diverse (e.g. energy intensive industry)? Is it related to companies or to households/individual persons? Does it concern processes or buildings?

When applying a new instrument it is also necessary to know about all existing instruments, which are already available. Some instruments can be very promising as such, however, it might be difficult to integrate them to an existing mix of instruments. For the policy maker it is important to know whether energy audits are already in place in one or the other



way (e.g. existing subsidies, existing regional or local activities, not energy related audit schemes etc), or if they are completely new. If they already exist – and this is often the case – then it might be worthwhile considering to build on these existing structures.

7.1.2 Definitions

Energy efficiency activities are successful, if they produce energy savings. However, these savings have to be realised by specific target groups such as building owners or enterprises. In the case of energy audits these target groups have to get informed and interested in energy audits – and most importantly – they have to get convinced to carry out an audit. To make this happen on a broader scale – in order to achieve high effects – a policy maker can use certain implementing instruments.

In principle two types of instruments can implement energy audits:

- Mandatory instruments;
- Voluntary instruments

“Mandatory” instruments are legally enforced by laws, directives, regulations etc. If instruments are not legally enforced they are per definition “voluntary”.

Overall Framework

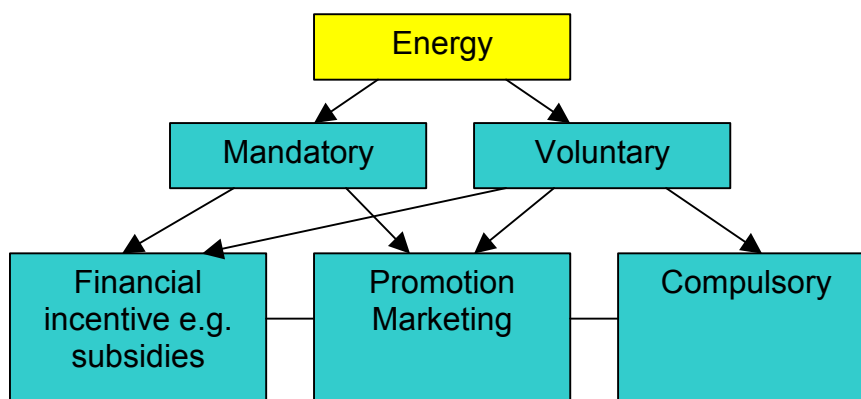


Figure 7.2 The “big picture”: the basic options (paths) on how to implement energy audits



With each of these two types a set of basic options can be applied, to convince a target group to carry out energy audits. Mostly the following options are used:

- **Financial incentives** are mainly based on tax or subsidy schemes, using the “money” argument to make a target group undertake an energy audit;
- **Promotion/marketing activities** can be used to inform the target group about the advantages of carrying out an energy audit;
- **Compulsory instruments** can be used to make energy audits compulsory within a certain programme or scheme which can be chosen on a voluntary basis, e.g. within agreements.

These three options can be combined or they can stand-alone. Very often they are integrated in a programme structure, having a clear time frame and defined goals and target groups. All these elements are mostly embedded in an **overall (policy) framework**, e.g. in an energy or climate strategy or an action plan, either on national, regional or local level but also on EU level.

7.1.3 Recommendations

Linking energy audits to an overall framework such as an energy efficiency plan, a climate strategy or similar (policy) frames can be very helpful to start up a programme, especially if strong (quantitative) targets are in place. This link is definitely necessary when using mandatory instruments, as they need a legal basis. With voluntary ones it depends on the applied basic options.

In general energy audits are integrated in programme structures, to take into account the specific conditions of a target group. Programmes fulfil also other purposes than “only” the audit aspect. They can be especially designed for certain target groups; e.g. agreements take into account the wish of the target group “industry” to avoid legal implications. Energy performance contracting schemes take into account that the target group “Building owners” sometimes has investment problems. Energy benchmarking proposes a comparison with competitors, and so on. Therefore good programmes are designed in a way that they address the specific needs of a target group. If energy audits can be linked to these needs, then the policy maker is on the right track.

Increasing energy efficiency also demands long-term dedication. By using programme structures this long-term perspective can be taken into account, fulfilling at the same time the policy maker’s wish to monitor and evaluate the effects of energy auditing.

When energy audits are connected to mandatory instruments in principle no other instruments are required, except for social and information reasons. Therefore subsidies as well as promotion should be considered. Mandatory instruments seem to be better applicable for large and homogenous target groups, such as customers of the building sector or small and medium enterprises. Labelling schemes and building certificates but also energy management procedures can serve as programme examples.

Bigger companies are mostly well organised and have means to avoid mandatory constraints. Therefore it has to be taken into account if legal enforcement is practically possible.



If the policy maker opts for voluntary instruments energy audits can either be integrated as compulsory element or as totally voluntary feature. Agreements are an example how audits can be made compulsory for a target group in case it signs a negotiated energy efficiency “contract” with the policy maker. To convince the target group (often industrial enterprises) to do so mostly financial incentives are applied, using in general links to the tax system (tax advantages) or subsidies (partly financed audits or investments). Whether the one or the other is better suited (or both) depends mostly on national circumstances.

The less “compulsory” energy audits are or the weaker the incentives are, the more promotion and marketing is needed to make the target group undertake an audit. If energy audits are planned to be totally voluntary then financial incentives should be combined with strong promotional activities. Financial support is mostly applied in form of subsidies, either to partly finance the audit itself or the investments. Without financial incentives in place voluntary action could be triggered by well-designed services related to a target group’s specific needs.

Voluntary instruments seem to be better suited for smaller not so homogenous target groups. Agreement schemes might be appropriate for large building owners or industry.

Promotion and marketing activities are to a certain extent necessary in any case and relevant resources have to be foreseen by the policy maker. If target groups are not informed about certain incentives they will not use them. Smaller target groups can be addressed by face-to-face meetings, presentations and specific events. Paid ads or campaigns are better suited for bigger groups. Different printed material has to be available in different phases of the programme, while Internet gets the usual media channel for distribution.

Energy audits have to be treated like any other service to be sold on the market. Therefore promotion and marketing should be done by professionals.

Important:

Different types of implementing instruments can be used to convince a target group (e.g. building owners, companies, SME) to carry out energy audits, however, the decision maker has to make sure, that the chosen instrument(s) fit(s) well into the existing national/regional/local policy mix.

Notice:

Target group, time frame and available resources have much influence on the chosen instrument.

7.2 Training, Authorisation and Quality Control

7.2.1 Definitions

Training connected to an energy audit programme means that a certain group of people is trained to do energy audits. The training may include only the energy audit procedure and/or the technical issues connected to it or the training may cover a wider range of topics (marketing, financial, environmental, etc).

Pre-qualification means that some requirements are defined for the persons who apply for auditor training or authorisation. These requirements can be based on basic education and/or



on working experience. Different levels of pre-qualification may lead to different levels of training or different categories of authorisation.

Indication of competence is the threshold from training to authorisation, usually in the form of a test (theoretical or practical) or a pilot audit. This element can be also used without actual training, based on certain pre-qualifications and leading to authorisation.

Authorisation of an energy auditor is his “licence” to perform audits within the audit programme. The authorisation may concern a person and/or a company. Usually the authorisation is valid for a specific area and for a limited time.

Quality control in an energy audit programme means that the auditors’ work is checked – usually by a neutral body (the Operating Agent or a team of controller consultants). Quality control is the most effective way to avoid serious quality problems in the energy audit programme. It is the guarantee for the auditors that the requirements are equal for all – and also a guarantee for the clients of the quality of auditors’ work.

7.2.2 Introduction

The Administrator usually defines goals for the energy audit programme and the connected activities (the goals may also be included in a national policy-level document). The aim is usually to reduce CO₂-emissions or to improve energy efficiency. This means that the audits should produce good energy audit reports which give the client adequate information for implementing the suggested saving measures. To reach the programme goals the Administrator and the Operating Agent should therefore put a real effort in ensuring the best possible quality of audit reports – by using training, authorisation and quality control as tools.

If the main aim of the programme is just to have a large number of energy audits carried out in a short time, no matter what the implemented outcome from the audits is, there is no serious need for training, authorisation or quality control.

The higher the requirements for the energy audit programme, its duration and its results, the more important the quality of the audits. If unskilled auditors are allowed to make audits and there is no quality control, the energy audit programme will stop by itself in a year or two.

The main aims of training, authorisation and quality control are

- To maintain a touch on the audit business and auditors;
- To keep the non-professional auditors from the business;
- To ensure that all auditors do the work in a similar way and produce equal quality of work to clients;
- To assure the clients and auditors that the quality and public image of audits is appreciated and controlled.

Energy auditor training, authorisation of energy auditors and quality control are the three elements are probably the elements in an energy audit programme that are the most connected with each other. However, there are connections to other audit programme elements that should also be taken into account. Programme administration as well as the audit models, have an effect on training, authorisation and quality control.



Figure 7.3 illustrates the connected elements of training, authorisation and quality control. Training and authorisation are more a pair and the two elements may not actually be separate from each other – authorisation is often a normal continuity to follow training, often through the indication of auditor's competence.

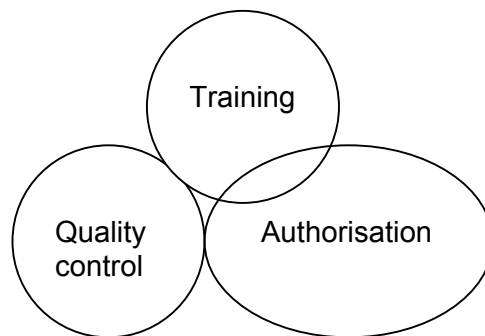


Figure 7.3 Connections of training, authorisation and quality control

Depending on the Operating Agent's choices on the three elements, the actual effects and also the required resources vary. Therefore the choices concerning training, authorisation and quality control should be based on the following questions:

- What are the aims and reasons?
- What are the resources that are available?

Some of the choices between the different options can be done independently but some have an instant effect to the other elements or exclude some of the next options. In parallel with this process the required resources and related costs should be estimated, at some point the need and availability of human and financial resources may no longer be a match. Something may look very good but it is too expensive, too heavy or too complex for the Operating Agent to administrate, so something needs to be lightened and part of the planning process will be repeated.

The size and intended duration of the energy audit programme has an effect to the training programme. It is clear that the smaller the size and shorter the duration of the programme, the less effort is worthwhile putting into the training. If the audit market needs to be started quickly and a large number of auditors are needed light training is a good option. This needs to be compensated by a tight quality control.

Some choices, possibilities and comments on the three topics are presented in the following.



7.2.3 Training of Energy Auditors

The main question is whether auditor training will be arranged and in what way it will be implemented. The list of the main issues (with some sub-options) that need decisions from the Operating Agent:

The basic options



Figure 7.4 The basic options for the status of energy auditor training

If "no training" is chosen, there may still be some pre-qualifications for the auditors before they can enter the market. Authorisation may exist even if there is no training. Training is by no means restricting the Operating Agent's possibilities to develop a good energy audit programme but the OA should know what the consequences are.

If the training is recommended by the Operating Agent, there should be some incentives involved and that these incentives should give the auditor's company some advantage in the market compared to those who have had no training.

Mandatory training is a requirement to everyone interested in entering the market.

Pre-qualification connected to training

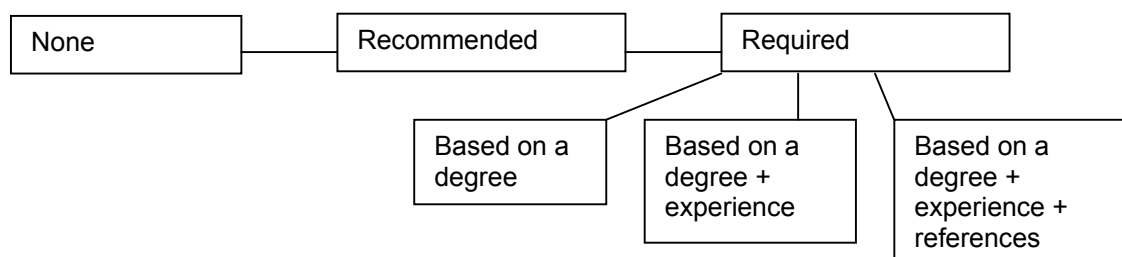


Figure 7.5 The basic options for pre-qualification for energy auditor training

"No requirements" is the easiest choice but it means that the auditor candidates coming to the training will have very different backgrounds and knowledge. Auditors with different technical background and expertise can't easily be trained to do good energy audits



Recommended pre-qualification is just a message to the auditor candidates on the basic skills needed for the work. This is an easy approach from the Operating Agent's point of view.

Required pre-qualification is the heaviest option for the Operating Agent, but it will bring several benefits. In "required pre-qualification" option there is always an application procedure involved. The heavier the requirements are the more work is needed.

The content of auditor training

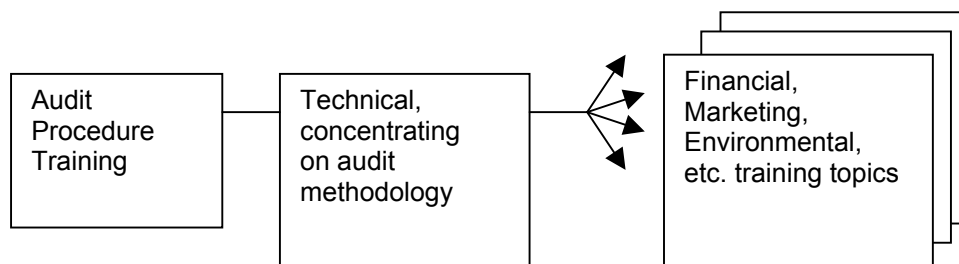


Figure 7.6 The basic options for the content of energy auditor training

The idea of procedure training is to explain how existing technical skills should be applied when working on an energy audit project.

The technical training on audit methodology may be carried out as theoretical training or also as practical training (including field work and measurements at a test site). For practical training a longer time and a test facility is needed.

Extending the training to other topics means a higher cost for the training and more work for the Operating Agent.

Indication of the auditor's competence

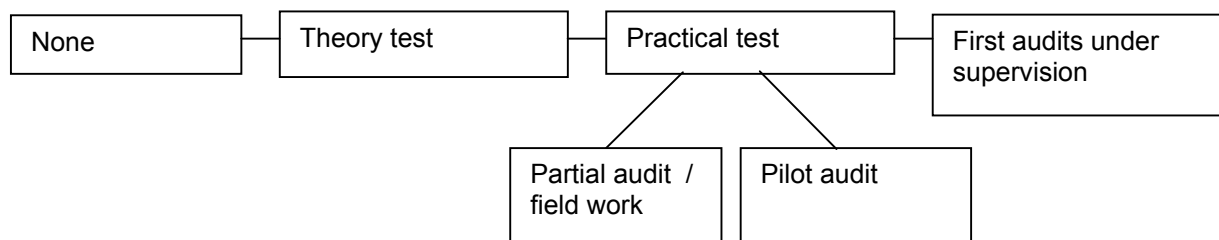


Figure 7.7 The basic option for indication of the auditor's competence



If the Operating Agent really wants to make sure that a certain level of competence exists, a method for the indication of auditors' competence needs to be defined. The Operating Agent can also arrange tests for the applicants with certain pre-qualifications or even without any pre-qualifications. In this sense the indication of auditor's competence is not necessarily connected to a mandatory training course.

A theory test is a light option to indicate the auditor's competence and it can be even arranged as a homework test without a real examination event.

The idea of the practical test is to ensure that in addition to his theoretical knowledge the auditor can also perform in the field. The test can be arranged as a test in a test facility or as a separate pilot audit with full reporting.

A real audit in the supervision of a senior auditor gives a good picture of the auditor's competence – this approach has a close connection to quality control.

The organiser of the training

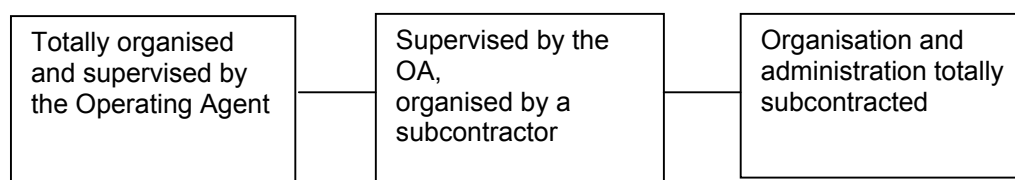


Figure 7.8 The basic options on the organiser of the auditor training

In the first option everything about the training is in the hands of the Operating Agent and the amount of work needed in comparison to the following options is higher. However, real audit experts should be used as teachers.

If the Operating Agent does not have the resources to organise the training, this part of the work can easily be subcontracted to a professional training organisation. It is important that the contract clearly specifies the roles and the fees of the subcontractor.

If the training is voluntary and/or recommended, the Operating Agent can subcontract the whole training activity.

The cost of the training

The level of the cost should be reasonable for the auditors and also in ratio to the expected volume of business and profits. However, the cost should be high enough to keep out the auditors who are not seriously interested in entering the audit business.

The expenditure of arranging the training varies depending on the status of the training but also on how it is arranged and marketed. The low cost option is to have the training arranged by the Operating Agent and the high cost option is to subcontract it to a professional training organisation.

If there is a need for a low training course fee and the training cannot be arranged without a subsidy, the Operating Agent should plan carefully how the subsidy is included.



7.2.4 Authorisation of Energy Auditors

The authorisation of energy auditors is one way to ensure that the non-professionals can be kept out from the business. Therefore, if the energy audit activity has a real meaning, some level of authorisation should be introduced.

The basic options

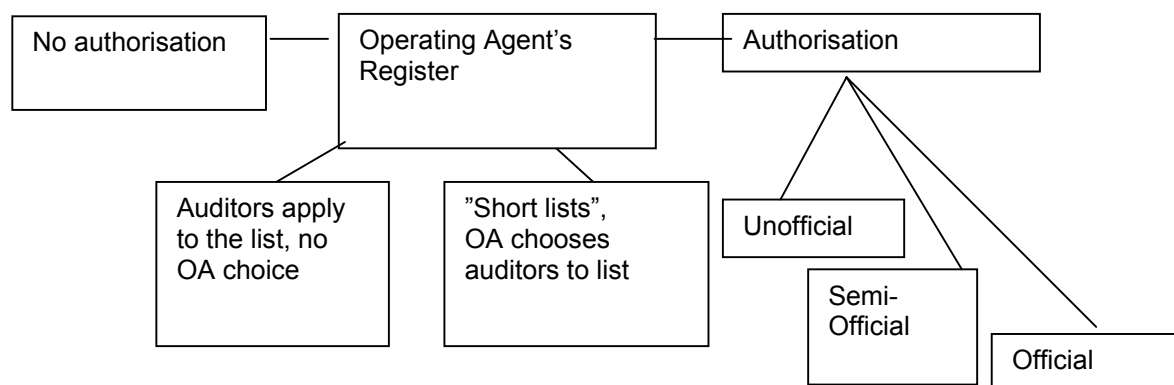


Figure 7.9 The basic options on authorisation

The Operating Agent's register is an option between actual authorisation and no authorisation. The list may include all auditors who wish to apply and have their names on the list or the OA chooses the auditors to the list according to some criteria.

Authorisation is unofficial when given by an association or an organisation representing a group of clients or e.g. the auditors. An unofficial authorisation is in practice just a strong recommendation.

The idea of the semi-official authorisation is that the authorisation is not official itself, but it is accepted by the Administrator who has set some official requirements, which this semi-official authorisation fulfils.

An official authorisation is based on a law or a decree, and/or given by an officially certified body.



The validity of authorisation

The authorisation may be valid for a limited time or forever. If the authorisation is permanent, the auditors will never be automatically removed from the market. Permanent authorisation is the light option but it can't be recommended without a strict quality control system.

The authorisation valid for a limited time can be arranged by connecting it to active operation in the market or to the participation in a yearly training.

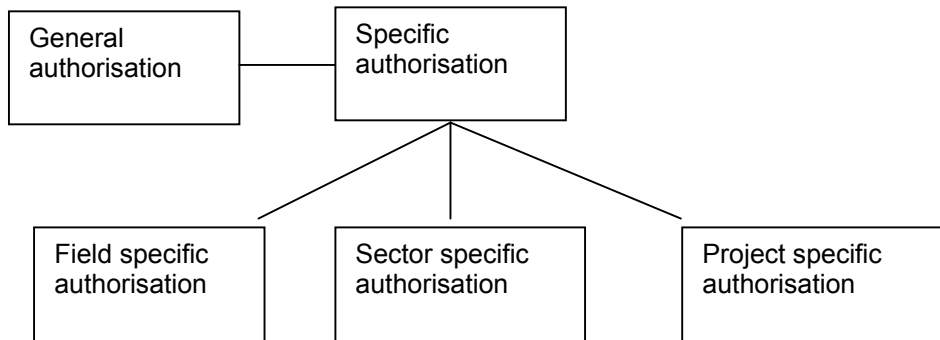


Figure 7.10 The alternatives on the area of validity of the authorisation

The area of validity defines the kind of auditing work the auditor may do or what kind of projects he may be involved in. The general authorisation means that all authorised auditors are allowed to do whatever auditing work in all kinds of projects without any limitations – this is the option requiring least administration work.

The field-specific authorisation allows the auditor to work in a certain authorisation area, for example as a mechanical or an electrical auditor. The sector-specific authorisation may be a good option to ensure that only competent auditors work in more complex projects. A rough division could be between auditors working in the service sector and those working in industry. The project-specific authorisation requires a lot of work from the Operating Agent, the authorisations are granted individually for each project.



The cost of authorisation

Defining a cost for the authorisation is one way for the Operating Agent to cover the cost of the services provided to the auditors. It is also a way to ensure that only those companies and auditors that really are interested in the work are participating. The level of the fee should be in a reasonable ratio to the business opportunities it will bring along.

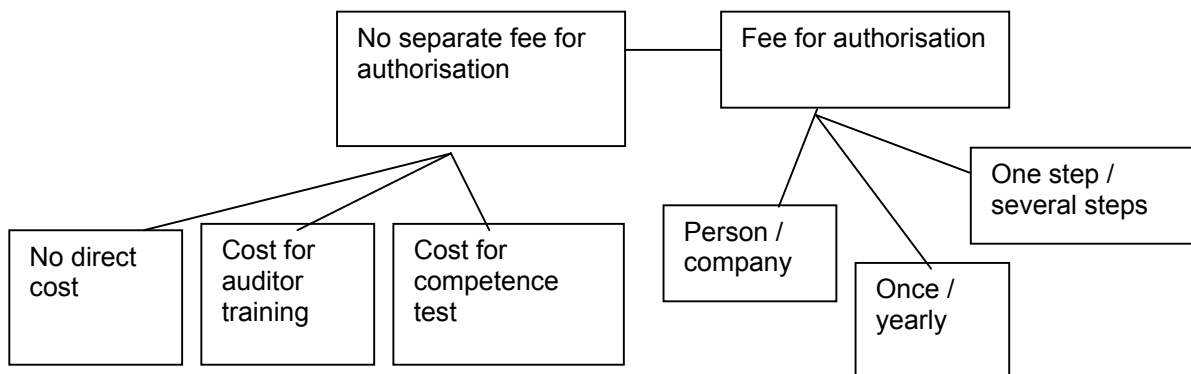


Figure 7.11 The basic options on the cost for authorisation

The connections to authorisation

The Operating Agent should be aware of all mandatory certificates and permits in the country. It might not be necessary to develop a totally new and independent system for an energy audit programme; it might be cost effective to take advantage of some of the existing authorisation schemes.

7.2.5 Quality Control

Usually the existence of systematic quality control is enough to maintain the quality at a reasonable level.

The basic options

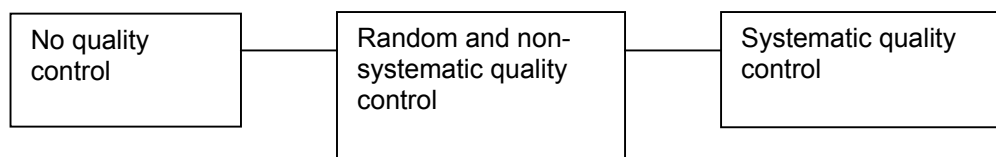


Figure 7.12 The basic options on quality control



The first choice means that it is totally up to the clients to decide what quality level is acceptable. The random quality control means that the quality control procedure is triggered by an internal or external impulse, such as client complaint. The systematic quality control means that the Operating Agent has a pre-defined procedure how the quality control is carried out.

Quality control may be based on the submitted reports or if it includes also site visits. On-site quality control of energy audits cannot be really used as the main option, because of the significant cost related to this option.

The coverage of quality control

One decision in the systematic quality control is the percentage of checked energy audits and the Operating Agent should set a target for the coverage. The coverage can also be higher in the beginning of the programme and then later, when a certain level of quality has been achieved, the coverage is lowered.

The Operating Agent should have clear criteria on how to choose the energy audit reports for quality control in order to increase the chances of finding those with the highest probability for poor quality.

The thoroughness of quality control

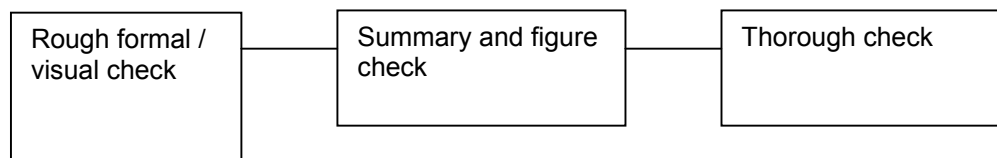


Figure 7.13 The basic options on the thoroughness of systematic quality control

The thoroughness of the quality control means the different levels of checking the reports – what issues in the report are checked. The rough visual check is based on just leafing through the report and the idea is to confirm that the guidelines concerning the format of the report are fulfilled. The summary and figure check can be used as the first step in a method of two-phase checking: all reports have a summary and figure check and those with clear irregularity will be chosen for a thorough check.

The thorough check option is what the clients expect to be done if the Operating Agent runs a quality control process. Checking the technical validity and saving potential of the suggested measures will improve significantly the total performance of a programme level activity. The thorough check needs a skilled quality controller.



The tools in the quality control

- Computer based figure-checking
- Checklists
- Self evaluation forms for auditors
- Audit client questionnaires for feedback

The Operating Agent can utilise various tools in the quality control process. The tools can be used to ease some routines but also to standardise the process itself. A checklist for the quality control procedure is useful especially if there are several persons doing the work. It will ensure that all reports are checked using the same criteria and it also enables the use of a scoring system.

Feedback from the client is always valuable although it does not necessarily give reliable feedback on the auditor's skills.

The costs of quality control

Are the costs covered

- By the Administrator;
- By the Operating Agent;
- By the clients;
- By the auditors;
- A combination.

One of the key questions connected to quality control is the total cost of it and who will be directly responsible for the financing. The Operating Agent can raise at least a part of the costs of quality control from the auditors in the form of a yearly authorisation fee.

The performer of the quality control

The possibilities for quality controller

- The Administrator;
- The Operating Agent;
- The clients;
- A consultant or a team of consultants.

Depending on the approach, quality control can be lot of work by competent people. The competence involves auditing skills, technical skills and also the knowledge on auditing guidelines.

The quality controller should be neutral, have the technical expertise and have the resources to handle the amount of work and to meet reasonable deadlines.



The financial connections of the quality control

There are some possibilities for how the subsidy payment is connected to the quality control

- The audit subsidy is paid before quality control;
- The audit subsidy is paid after the quality control;
- Subsidy payment is connected to the implementation of saving measures.

The quality control has connections to the financial aspects of an energy audit programme. If there is a subsidy scheme involved, the Operating Agent should consider what kind of connection there is to quality control.

If the subsidy is paid before quality control the only way to force an auditor to correct a poor report is the threat of cancelling his authorisation. This option is not necessarily a poor one if the general quality of work is good and the auditors are competent.

The effect of the quality control is stronger if the subsidy is not paid before the auditor's work has been accepted. But this option sets tighter schedule limits for the control process.

There are different ways to combine the first two alternatives and also to combine them to the implementation of the saving measures suggested in the report. In theory this is a good way of ensuring that the audit will lead to actual savings and the client takes action after receiving the report – in practice this option leads usually to heavy administration.

Notice:

There are different options on how to put into practice these “quality assurance elements” which (to some degree) support and compensate each other. Light training and authorisation can be compensated by a strict quality control. However, one of the three “main pillars” must be strong.

7.3 Monitoring

7.3.1 Introduction

Energy efficiency programmes are important and successful as long as they produce results in energy savings. Well-designed systems for monitoring and evaluation are essential in an energy audit programme to provide information on the actual impact and results of the programmes and the use of public resources. Governments are increasingly demanding to know exactly what comes out of the resources they allocate to different schemes and programmes. In addition, a well-designed monitoring system is of interest to the clients and the auditors, in order to get feedback on the results and quality of the work.



We have used the following definitions of monitoring and evaluation:

- **Monitoring:** is defined as a continuous or repetitious activity running in parallel with other activities over the lifetime of the project in order to keep control and obtain information on the impact/result.
- **Evaluation:** is defined as an activity, which is undertaken by a third party at regular intervals over the lifetime of a programme (often years between) with the purpose of verifying the achievements of the programme and proposing possible measures to improve it.

7.3.2 Monitoring – the Different Levels

Figure 7.15 gives an idea of the different levels of monitoring. Each level produces information that is useful for certain purposes.

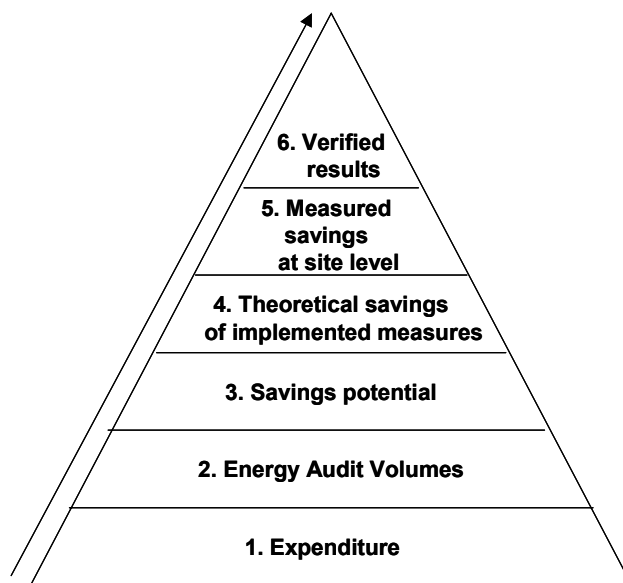


Figure 7.15 Relations between monitoring activity, information value and costs.

Level 1: Expenditure

This is just a simple monitoring of information concerning the recipient of the subsidy and the actual amount. This is done for accounting purposes.



Level 2: Energy audit volumes

At this level there is only simple registration and counting of the audits in total, for example with respect to sector and auditor. This gives a picture of the activity, but does not say anything about the possible energy savings.

Level 3: Savings potential

This gives information about what kind of measures have been identified and the savings in energy and corresponding costs and economics. The benefit of this monitoring activity is that it provides an overview of the economy and therefore the attractiveness of the measures.

Level 4: Theoretical savings of implemented measures

This level entails following-up of the outcome from the audits. The aim here is to find out what measures have actually been undertaken. This can be done through questionnaires or through site visits or a combination of both. Based on the data obtained, it is possible to calculate an estimate of the energy savings that have been achieved.

Level 5: Measured savings at site level

To increase the quality of the monitoring, it is possible to register the energy use at the level of a company or a building. For example, this can be done on a yearly basis through a questionnaire. This information will over time show if the implemented measures reduce the overall energy consumption of the factory or the building.

Level 6: Verified results

This level implies that the implemented measures resulting from an audit are measured and verified by a third party. However, in practice verifications are often undertaken using sampling methods, in which approximately 5 to 10 % of the representative measures are actually controlled. The overall result is then generated through the use of statistical methods.



Table 7.1 Characteristics of the different options - coverage, complexity and costs

Options	Coverage	Complexity	Theoretical cost		Information gained from
			Small scheme ¹	Large scheme ²	
1. Expenditure	All audits	Easily achieved	No extra costs	No extra costs	Subsidy application
2. Energy Audit Volumes	All audits	Easily achieved	Ignorable extra costs	Small extra costs - 0,25 man month/year	Subsidy application
3. Savings potential	All audits	More complex – tool necessary, i.e. database	Small extra costs. Need for spreadsheet – 0,5 man month	Development costs: 6 man months/year. Operation costs: 1 man month/year.	Audit report
4. Theoretical savings of implemented measures	All audits/samples	More complex – need for tool and feedback from clients	Operating costs in the range of 2 man months/year	Operating costs in the range of 4 man months/year	Questionnaire / site visits
5. Measured savings at site level	All audits/samples	Complex – need for tool, feedback from clients and analytical expertise	Costs in the range of 4 man months/year	Costs in the range of 1 man year	Questionnaire (yearly)
6. Verified results	Samples	Complex – need for tool, feedback from clients on measured data and analytical expertise	Costs in the range of 6 man months/year (based on representative samples)	Costs in the range of 1 man year (based on representative samples)	Monitoring on site level

7.3.3 Evaluations

Evaluations are usually carried out by a third party with the aim of providing an objective consideration of the impact and usefulness of a programme, i.e. if the programme has been successful or not. Such evaluations are usually carried out at the end of a programme. Evaluations undertaken during the mid-life of a programme usually serve as an instrument to correct the operation and direction of the programme. The quality of the evaluation increases with the quality of the monitoring. An evaluation usually consists of two phases, an information-gathering phase and an analysis phase. The kind of data that would be collected is dependent on the issues that are chosen for consideration.

¹ In the range of 10 to 100 audits/year, depending on sector
² In the range of 100 to several 1000 audits/year



7.3.4 Recommendations

The ultimate aim of undertaking monitoring is to obtain information about the impact of an energy audit programme. This information would determine the successfulness of the programme and initiate actions to correct certain characteristics or functions if the programme does not meet expectations.

There are different levels of monitoring, and each level will produce information that is useful for certain purposes. It is essential to design the monitoring system at the same time as the other characteristics of the programme. The monitoring system must be up and running from day one of the programme should it produce the desired effect.

Before establishing a monitoring system, it is important to carefully consider what kind of data should be collected, i.e. what kind of data is needed to compile the information for the public authorities spending public money on the programme. Their demands will to a large extent determine the data needed.

Even if the aim is to run a very limited energy audit programme with a small budget, it is necessary to take into account future developments. Therefore, the Operating Agent should always establish a simple database, where essential information about the companies and the audit can be saved and used to make energy statistics. Furthermore, the database should be flexible, i.e. allow for extensions. Such a database would allow for monitoring at level 3, which is deemed to be the minimum.

If there is a need to produce good quality information on the situation after the audit have been finalised, i.e. what the actual impact is, there is at least a need for a monitoring system at level 4. In this case, it is recommended to control a statistically significant number of samples.

The performance of an audit programme should be evaluated after it has been running for 2–3 years. The aim of the evaluation must be to provide objective information of the impact, usefulness, and operation of the energy audit programme in order to determine if there is a need for adjustments, if it should be closed down or if it should be kept unaltered. A third party must be responsible for the evaluation. The contractor of the evaluation should be the public authority/administration to which the Operating Agent reports.

Important:

Establish – at least – a simple database for monitoring.

Design the monitoring system at the same time as the other characteristics of the programme.

The more effort and cost you put into the monitoring system - the more information about the results you can obtain.



7.4 Energy Audit Models

7.4.1 Introduction

The term **energy audit** is in principle well known and commonly used. There is however one problem which can easily lead to misunderstandings. The fact is that the term “energy audit” is only a general term like “a car”.

The term “energy audit” is a good general definition but should also be used only as such. The variety within the family of energy audits should be understood as well as the importance of defining also the content and the scope of the audit in more detail. Most of the different kinds of energy audits have been developed on national level and for a specific purpose – like the different types of cars: vans, station wagons, sports cars.

The term energy audit as such specifies only in general the content of the working method but does not define the actual scope, thoroughness or aim of the work.

The audit sites and the client’s needs are different, for example

- Energy is used in different systems and for different purposes;
- The scale of energy consumption varies;
- The site can be at various stages of its life cycle;
- The size of the site varies;
- The interest may be in all energy use and all energy forms or the interest may be limited only to a part of the energy consumption (e.g. electricity) or to the possible change of energy form (renewable energy sources).

Therefore there is clearly a need for different kinds of energy audits, especially due to the amount and content of the audit work and also for the reporting of the results.

When the energy audit experts in the different European countries were interviewed, several different ways of performing energy audits were found. In practice there are different levels of instructions given for the auditing work. Many of these different approaches fulfil the criteria of a “model”, which is a good term to be used in order to separate the standard procedures from the “do-as-you-like” procedures.

The term **energy audit model** in this context indicates that there are agreed features or requirements designed for a specific type of an energy audit application. In a model the actual scope, thoroughness and aim of the audit are defined. The audit model is usually a standardised, commonly known and commonly followed procedure with written guidelines. The requirements are usually defined in the guidelines given by the Administrator and/or the Operating Agent.

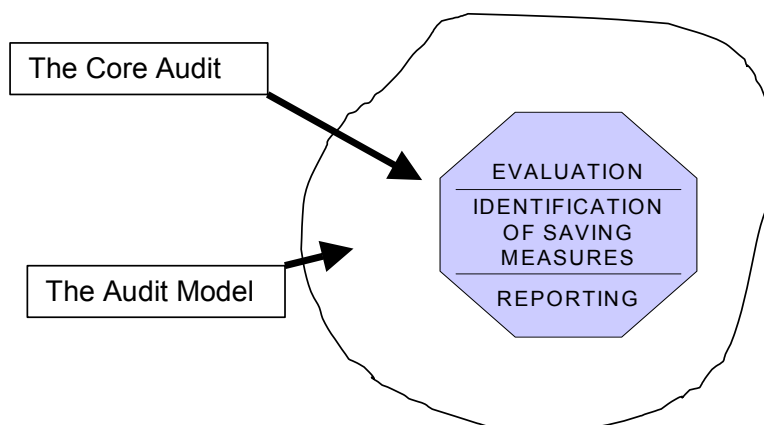


Figure 7.16 The energy audit model around the Core Audit

It is quite important for the programme developer to understand the theory behind the different energy audit models in order to picture the differences and consequences between the different audit model options.

The Administrator and Operating Agent should carefully consider what the target sectors and their needs are, what is the desired output from the audit programme and what kind of knowledge the auditors have. If the targets are defined first, it is fairly easy to design the audit models to fit the needs. If a model is developed without a comprehensive knowledge on the environment where it is supposed to work, the result might not be the desired.

7.4.2 Audit Model Features

The guidelines given by the Administrator and/or the Operating Agent describe the model – in practice the features are described as specifications on content of work, guidance on the fieldwork, checklists and model reports. Each energy audit model is connected to its cost, time, phasing and reporting characteristics, which should also be taken into account.

The cost of an energy audit is based on the auditors' fee, the labour cost of the client's own personnel or both. The audit cost is typically a model specific feature but has a strong connection to the subsidy policy on the audit programme level. The cost naturally depends on the technical systems and areas of energy use covered in the audit, on the thoroughness of work, etc.

There are different levels for the **reporting** of an energy audit: the report may be ultra light, simplified or detailed. The three options are also closely connected to the thoroughness of the audit work and its cost as well as to the programme level properties of monitoring and quality control.

Especially if the energy audit programme is targeted to industry, it may be feasible from the client's point of view to implement the energy audit in several phases. A typical approach is to have the first rough audit round, to scan the site, followed by one or several more detailed audits. The selection of the audit models should allow this in order to achieve a good penetration among the clients.



These features should not be defined in the audit programme planning phase before a thorough analysis of the need for different audit models. For example defining tight limits for the cost of an energy audit as the first step will certainly lead to difficulties with audit quality, audit volumes and market penetration. If the cost is low, the auditors may not be interested in the business – or will produce very light reports. If the cost is high and no subsidies are available, the clients are not interested.

7.4.3 The Basic Energy Audit Models

The **scope** of an energy audit may be different in different target sectors or client groups: the audit may cover a building or a site in various ways. The narrow scope energy audit covers typically only a specific system (such as a compressed air system) while the wide scope audit may cover all energy use within the site.

The **thoroughness** of audits may also be different - in his work the auditor may use “a fine or a rough comb” when looking for the energy saving potential. Normally the thoroughness of the work is directly related to the time and cost of the audit.

Energy audits may also have different **aims** and they are used for different purposes. They can either at just point out areas where energy savings can be found or describe in a detailed proposal specific saving measures.

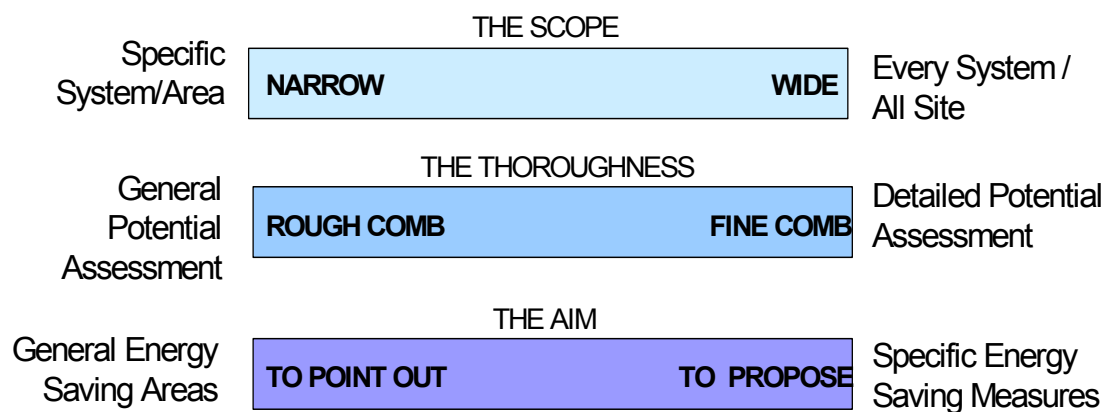


Figure 7.17

The properties of energy audit models



The main aim for an energy audit divides the audit models into two main types. Therefore it is an essential choice for the programme developer to decide if the aim of the energy audit is just to point out possible saving areas or to suggest detailed saving measures. This decision is crucial for the model development.

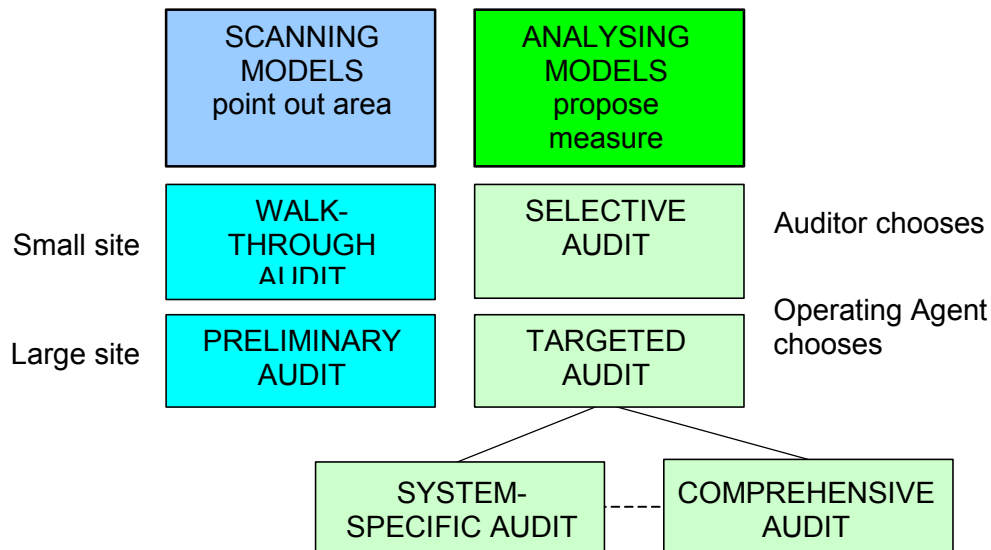


Figure 7.18 Basic Energy Audit Models

The main aims of Scanning Energy Audit Models are to point out areas, where energy saving possibilities exist or may exist and also to point out the most obvious saving. Even if this type of energy audit may sound like an easy task, a very experienced auditor should perform the audit if any results are expected.

The scanning models can be divided into two main types:

- *A Walk-Through Energy Audit* is a scanning model typically used in tertiary buildings where the energy consuming systems are quite simple and the probable areas for potential energy saving measures are known in advance.
- *A Preliminary Energy Audit* is the scanning energy audit model for large sites in the process industry. Most of the work in the Preliminary Energy Audit is in building up a reliable breakdown of the present total energy consumption and in defining the areas of the significant energy consumption. The audit points the most obvious savings and also points out the areas where supplementary “second-phase” audits are needed and how they should be targeted



A scanning audit model is a good choice if large audit volumes need to be achieved in a short time. These types of audits are usually quite cheap and quick to carry out. From the client's point of view a scanning audit may not bring the expected results, because it does not necessarily bring actual saving measures, ready for implementation but usually suggests further analysis of key areas.

The Analysing Energy Audit Models produce detailed specifications for energy saving measures, providing the audit client with enough information for decision-making. These types of audits are more expensive, require more work and a longer time-schedule but bring concrete suggestions on how to save energy. From the client's point of view the saving potential can be seen and no additional surveys are needed.

The analysing models can be divided into two main types, based on the accuracy and limiting features of the guidelines given by the Operating Agent:

- For the *Selective Energy Audit* the Operating Agent gives only general guidelines and therefore the auditor is allowed to choose the level of approach, both in coverage and accuracy. This audit model is very cost-effective when used by neutral, target-oriented and experienced auditors but may also, in the worst case, concentrate on only the obvious savings and ignore everything else. From the Operating Agent's point of view this model is problematic because the quality control on this kind of audits is very difficult.
- For the *Targeted Energy Audit* the Operating Agent defines clear specifications on the content of the audit. The audit may concentrate on one specific energy using system (boiler, compressed air system) or cover all energy use of the site. There are various possibilities to create the technical content of a targeted audit. This model creates a basis for a standard and detailed reporting which brings some advantages to the Operating Agent especially in quality control and monitoring.

The targeted audits range from a One-system Audit to a Comprehensive Audit that covers all energy use.

The *Comprehensive Energy Audit* is one of the most typical applications of the Targeted audits. The Comprehensive audit covers all energy usage of the site, including mechanical and electrical systems, process supply systems, all energy using processes, etc.

7.4.4 Recommendations

The selection of energy audit models in an energy audit programme depends on various issues:

- The goals of the programme (energy saving, reduction of CO₂, etc);
- The target sectors of the programme;
- The volume goals of the programme;
- The auditors' skills.

The models are usually different for different target groups. In heavy industry a multi-phase audit starting with a scanning model is a good option whereas in the tertiary sector



comprehensive audits are often used. The number and type of models is a programme- and country-specific issue and should be considered parallel with the general goal setting and development of the programme elements.

It is not unusual that an energy audit programme has one or two models in the beginning and more models are developed later. It is usually too time-consuming and costly to develop several models when the programme is started - starting with only a few models is a financial compromise.

The programme may be expanded later to cover new target sectors and there is a need for new audit models to meet the new demands. This would be the ideal situation for the Operating Agent: the new sectors are known well in advance and there is enough time to prepare the guidelines for the new models. The development phase of a new model is 1-2 years, because each new model should be tested in pilot projects before being included in the guidelines.

If the programme has been started with too few audit models, the needs for new models come rather soon from the auditor and client feedback and also from the quality control procedure.

In the model planning it is essential to be aware of the fact that by selecting and fixing one single feature (such as type of reporting) as the first step, the selection of applicable energy audit models may be restricted. Starting the planning process from the wrong end may lead to a situation where the audit model does not fit the needs of the clients, auditors or the Operating Agent.

Some of the choices on models will have an effect to programme level decisions. If the model Selective Energy Audit or the model feature "ultra light reporting" are chosen, the quality control of the energy audit reports on programme level will be pointless. On the other hand the model feature "detailed reporting" and a good monitoring system could provide the Administrator and the Operating Agent plenty of realistic and valuable information on actual energy saving potentials.

The clients often require broader service in connection with an energy audit, not just a list of viable energy saving measures. Also the effect of energy auditing can be significantly improved by some additional services provided by the auditor. Therefore the theoretical Basic Energy Audit Models shown here are usually formed in practice into different types of applications with connections to Energy Management, staff training, ESCO-activities, etc.

When planning the audit models, the Administrator and Operating Agent should listen to the opinions of the client groups and auditors. Combining the other elements of the programme to the practical audit work needs a thorough analysis.

Notice:

An energy audit programme will not work properly if there are no clearly defined audit models that fit the needs of the client groups and the skills of the auditors.

Important:

An Energy Audit Programme can start "small", that is with only one general Energy Audit Model. Refinement by development of complementary EAMs will follow to adapt to the clients' needs or the marketing options.



7.5 Auditor's Tools

7.5.1 Definitions

The wording "**tools for audits**" or "**auditors' tools**" describes a large family of support documents and applications which are intended to facilitate the work of auditors in the view of both minimising audit costs AND maximising audit quality.

They are generally dependant from the Energy Audit Models but may address different stages in the study service as figured underneath and provide help either on technical matters or on marketing aspects.

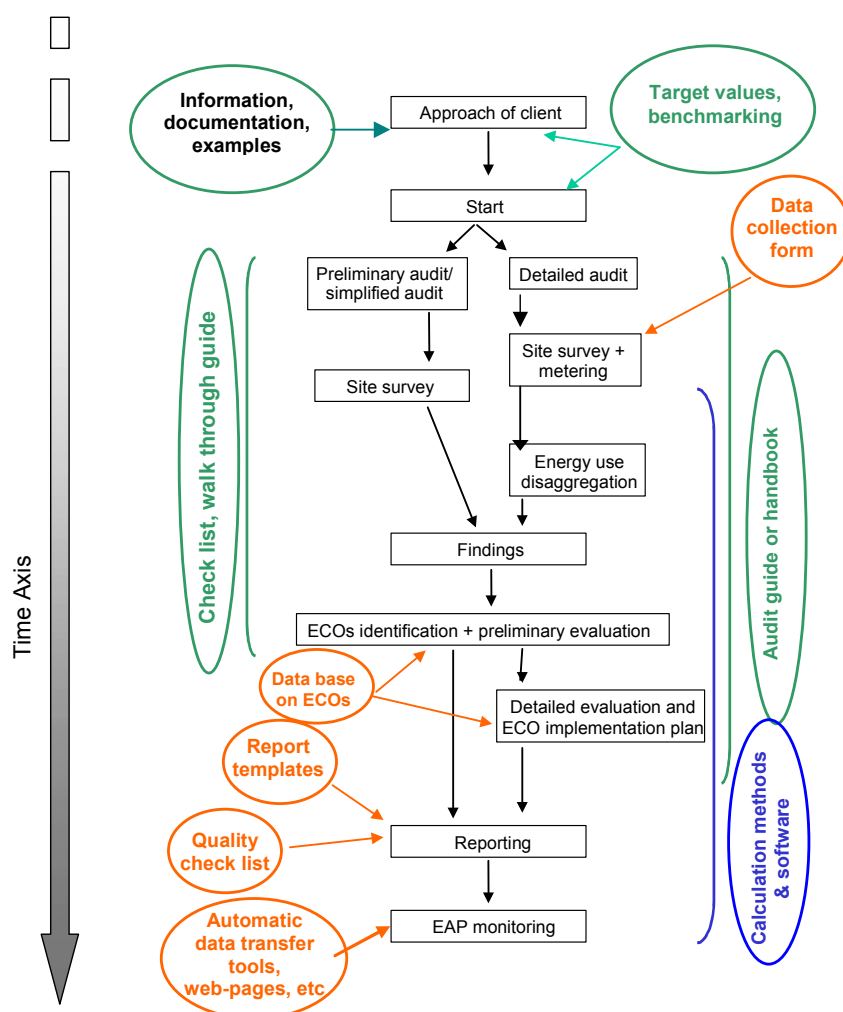


Figure 7.19 Flow path of an energy audit and indication of tools related to various steps

Tools may take different forms or media: flyers, guides or booklets, films, Web sites or CD-ROMs and the choice of the media, although important is often a compromise taking into account: cost of production, cost and easiness of dissemination, nature of the content.



7.5.2 Introduction to tools variety and complementary

Definitions	Pros and Cons, comments
Information/documentation on technical topics (ECOs³, Branch specific...)	
Information support document, it is often based on case studies and intended to help marketing the audits in view of successful examples. Main target is the client of the audit.	Depending on the accuracy of the information these tools can also be considered and/or used as promotion support elements. These tools give clear message from the Administrator or the OA to the public
Audit guide or audit handbook, energy management handbook	
This tool explains and describes how an audit is to be made, how the calculations are to be conducted, the types and contents of the most frequently proposed energy conservation options (ECOs).	Core component of an energy audit scheme, the document is the basis of training sessions and is targeted essentially to auditors
Energy checks, Check-lists or walk through guides	
Associated to energy audit models of the scanning type, these supports are developed in order to facilitate the work of the auditor, assuring in the same time both quality and rapidity of the survey.	They can be used by energy managers for their own site or premises on a self auditing basis or more widely as a simple awareness raising instrument
Calculation methods and software	
Other core component of energy audit schemes, calculation methods and software are associated to energy audit models of the analysing type.	The use (by an auditor) of a recommended or certified (by the Operating Agent) calculation tool is an insurance of the quality on the results for the audit client. Developing software may become extremely expensive and time consuming for the Operating Agent.
Data collection form(s)	
Generally associated to the calculation tool for which they constitute the input data, this type of support document helps the auditor in collecting all the necessary information for the survey.	It will be part of the final report and will also contribute to facilitating the follow up of the site energy features and the interpretation of the audit results and recommendations.
Report templates	
The report is the deliverable of the audit, proposing a template helps all the participants to make the most profit of the audit service, produce similar audit reports and good audit quality.	They are over all depending on the energy audit models and, in many programmes are integrated in the audit model specifications. As for data collection forms, they are frequently associated with the calculation tool of which the output results must be integrated in the report.
Check list for quality control of audit reports	
What is specified in the energy audit model, as expected results should be in the report: the checklist is an easy way to verify that the work has been done accordingly to the specifications.	Document to be used both at Operating Agent level and at auditor level (self-check), it is a complement or an alternative to report templates and a practical translation of Energy Audit Models
Building ratings, target values or benchmarking	
Key figures that can be used either as marketing information to spark off the need for energy audits.	They are also used by the auditors as technical data to justify their recommendations in the case of simplified audits, and even can contribute to detailed audits in checking calculations or replacing data difficult to meter or evaluate either way.
Data bases on energy conservation Options (ECOs)	
Detailed information on costs and implementation side aspects or consequences of energy saving recommendations. A database of ECOs will save a lot of time and money to the auditor (and thus help lower the cost of the audits with a maintained quality).	Keeping the data up to date requires quite a lot of work from the OA.

³ Energy Conservation Options



Use of any of these tools can be made compulsory or voluntary within a scheme; the Operating Agent may even decide that he will not provide any of these and let the market work freely but the OA must be conscious that the quality of the audits and thus the efficiency of the whole scheme rely highly on his providing the right instruments for the precise audit phase(s).

7.5.3 Recommendations

There is no unique "tool box" in the field of Energy Auditing Programme; it must be a mix of the various existing options that fits to the market needs: the audit market and the consultancy market.

Thus at each step the Operating Agent must consider:

- First, what his objectives are in terms of market penetration of audits: 5 % or 10 % of the target sector stock or potential per year (see chapter on dimensioning issues);
- Secondly, which are the resources on the auditors' side: how many consultants are able to work on the identified market? Do they have the correct "instruments" to market and realise the audits in due time and within acceptable economic conditions (in terms of price for the client as well as cost for themselves).

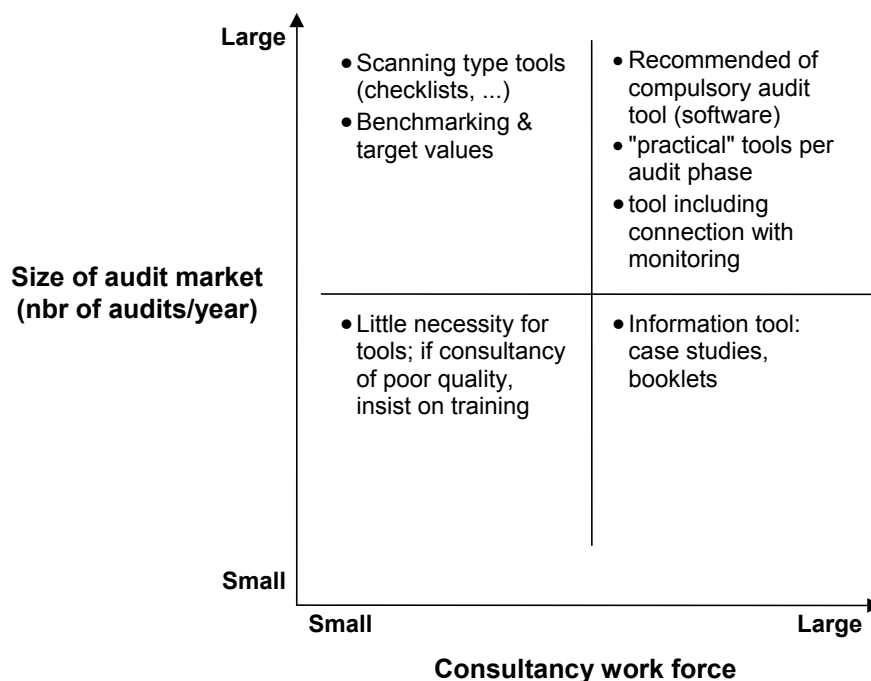


Figure 7.20 Mapping of tools depending on programme size and professionals



The larger the scheme and the scarcer the consultancy professional resources, the more necessary it will be to develop tools to adjust to the market.

The Operating Agent has the ability and the responsibility to select the most appropriate tool(s) to improve the scheme results. This is depending on the status of the audit programme - whether it is starting a new scheme or managing an on-going one. It also depends on the quality of the feedback (highly depending on the monitoring and evaluation),

Tools for auditors is not THE essential element of an auditing programme, but it is one topic that brings multiple benefits:

- Some tools can be also used as marketing instruments (case studies, fact sheets...) or contribute to the training sessions (auditing hand book, software tools...);
- Quality control as well as monitoring may be eased through adequate dispositions within practical tools;
- And even definition of the Energy Auditing Models can interact with the tools definition or development (although EAM definition should precede tools elaboration).

Warning:

There is no unique "tool box" in energy auditing. Tools are only a means to make things work properly by responding to the market needs: audit clients and consultancy task force



8 Evolution of an Energy Audit Programme

Based on the ongoing energy audit programmes the fact is that a programme is never completely ready. For many reasons some of the basic elements need to be developed further during the lifetime of the programme. The need for development can appear for the following reasons:

- The element has not been properly planned in the beginning;
- Changes in the target sectors;
- Changes in the environment where the programme is run;
- Changes in other basic elements.

In order to maintain the programme operational the Administrator and the Operating Agent must be prepared to carry out the needed changes, which require both financial and personnel resources. Typically, developing a new energy audit model, the average development cost is in the range of 15 to 25.000 € and furthermore it can take up to 1 to 1½ years before the new model can be put into force. Changes in one basic element normally affects also the other elements and therefore all interconnection must be carefully analysed the whole process, including changes in the other elements, well planned and scheduled.

8.1 Evolution of One Basic Element – Case: Energy Audit Models

Figure 8.1 is an example from Finland and illustrates the evolution, which has taken place with the energy audit models. The programme was started as a subsidy scheme in 1992 and developed into a programme level activity during 1993. In 1994 the first energy audit model was published and since then total of 9 new models have been developed and put into force. The reasons why these models have been developed cover probably all possible reasons a programme developer or the Operating Agent can face during the life-span of an energy audit programme.

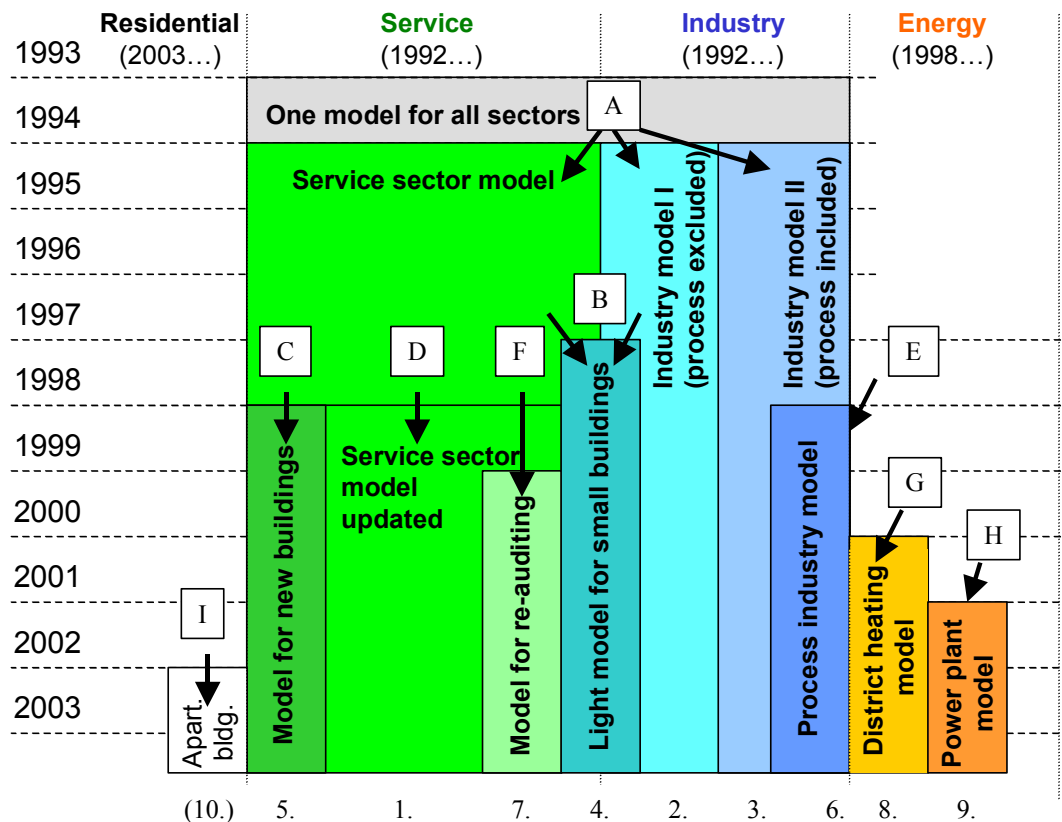


Figure 8.1 Evolution of energy audit models in Finland

Based on the energy audit reports from year 1992 it was clear that a standard energy audit model is needed in order to improve the quality of energy audits. Some 20 % of all reported audits were of poor quality. The first energy audit model was developed in 1993 and published in January 1994, which is also the year when Finland's Energy Audit Programme was launched. Subsidies for energy audits had been available already in 1992 and 1993 but only within a subsidy scheme – not within an actual programme level activity.

- A.** During year 1994 it became clear that one model couldn't be used in both service sector buildings and in industry. This complaint came from several energy auditors. Based on the energy audit reports from industry the quality control had also found out that the reports are of three different types. One type was concentrating on building itself, which would have been enough for the service sector buildings but not in industry. The other energy audit type had the processes ignored, which in some cases was acceptable but in some cases it was clearly bypassing potential savings. The third type was a comprehensive model where also the process was thoroughly analysed. As a result from these findings three different models were introduced in 1995. The service sector model remained very close to the first model introduced in 1994.



- **B.** The second development phase took place because several auditors complained that the service sector model is too heavy to be used in small buildings. This was really the case and this new model was also allowed in small industrial buildings.
- **C.** The next development started when it became evident that auditing in new buildings is different compared to auditing the old buildings. The idea of having an audit done in the post-acceptance phase to tune the energy consumption into an efficient level had come up already in 1996. Many of the energy saving measures found in old buildings had been causing unnecessary energy consumption from the day the building was constructed. The new model for new buildings was put into force in 1999.
- **D.** The first service sector model, introduced in 1994 had finally come to the end of its lifetime and an updated version was put into force in 1999.
- **E.** The process industry entered the energy audit programme in 1998 as a result of the Voluntary Agreement Scheme signed in 1997. Due to the major differences in this new “subsector” in comparison to medium size industrial companies, there was a need for a new model. This multi-phase energy audit model is quite different in comparison to the other models all of which are single-phase models.
- **F.** For some time there had been a need to upgrade energy audits that had been carried out during the previous years. For clear practical reasons there was no point to demand for complete re-auditing nor to subsidise one. In most of the cases major part of the information presented in the previous audit report was still valid. A model for re-auditing was developed in 1997. The model was thoroughly tested before putting it into force in year 2000. Re-auditing was also made possible in the industry but due to the heterogeneity of the sector no separate model was developed. In industry the auditors are obligated to apply the basic industrial models “the best suitable way”.
- **G&H.** The energy sector joined the Voluntary Agreement Scheme in 1997 and committed itself to carry out energy audits as well. Some hesitation took place before a decision was made to start developing models to this very special area. In 2001 the first energy sector model for district heating systems (G) was introduced. A model for power plants (H) was introduced in 2002.
- **I.** The latest of the models is a model for apartment buildings. A Voluntary Agreement was signed in this sector in 2002 and with the obligation to energy auditing, also required its own model.



Although the number of energy audit models is quite high, there is still a need for new models in the near future. Some specific systems, e.g. the compressed air systems, should have separate models or sub-models because the idea is to use them inside the existing industrial models. There is also a decision to develop a new model to evaluate the potential for renewable energy sources in the municipality areas. In Finland the definition energy audit has become the common nominator or “the family of working methods” under which energy saving measures - and today also the switch to renewable energy sources - can be analysed in various sectors and areas. Good examples from other countries show that the audit methodology can be used also outside the buildings e.g. to assess the savings in street lighting, transportation fleets etc.

8.2 Cross-effects in the Development of the Basic Elements – Case: Integration of Renewable Energy Sources

In order to maintain the whole programme operational the Operating Agent must be able to analyse the cross-effects between the 12 basic elements. If one basic element is changed, there will be a need to change some of the other elements as well. This is one reason why any changes in the basic element should be well based. In this example the change in one basic element affects actually total of 7 basic elements.

The fact that there is no need to make all changes at the same time is a relief. But the Operating Agent must be able to plan the whole process and understand when these changes are needed and how long it will take before the basic element in concern is operational. E.g. the basic element promotion and marketing should take care that all key players are aware on the changing situation at the earliest possible stage. On the other hand the basic element monitoring does not have to be operational before e.g. energy audit reports based on a new model start arriving for quality control.

In Finland the need to integrate renewable energy sources into the energy audit programme became evident in the year 2000. This possibility had been understood already a few years earlier but due to many other development projects there were no resources available to do anything. In 1999 the Government published the Action Plan for Renewable Energy Sources. Although the Action Plan does not directly mention energy audits by the definition, the Voluntary Agreements were mentioned. And since the energy audits are used as a tool within the Voluntary Agreements, the Operating Agent (Motiva) took a proactive role and launched a development project. In figures 34 and 35 the flow charts illustrate the cross-effects of the process, which started from a change in the basic element Goals for the Programme in 2000.

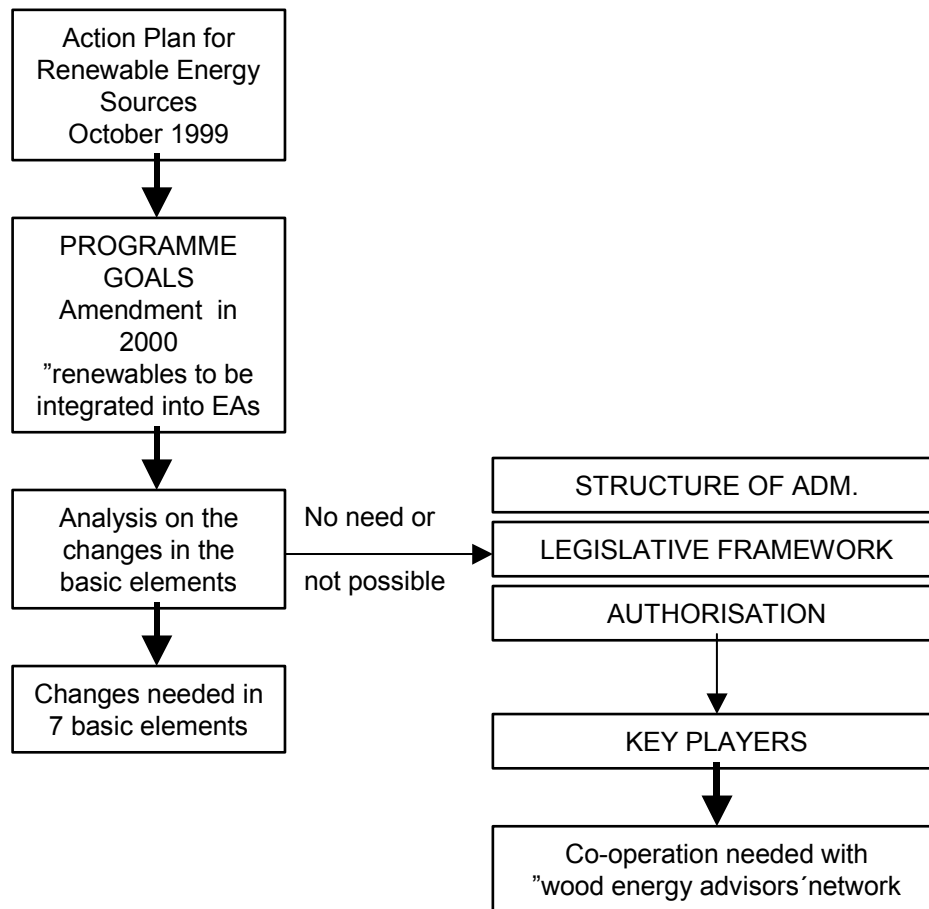


Figure 8.2 Analysis of the basic elements to be changed

Figure 8.3 presents clearly how one change actually affects 7 other basic elements and how these changes take place during a 5-year period. The effect of the change, the integration of renewable energy sources into the energy audit programme, will be seen 4 to 5 years after the decision. This is probably one of the longest lags in an energy audit programme, but it has been one of the major changes ever implemented in Finland's Energy Audit Programme. Smaller changes have been carried out in a shorter time period, but typically a new model will take 2 to 3 years before the Operating Agent can see if the taken decision has been correct and if the market place has adopted the new approach.

Notice:

Each programme has it's own history. So, start the activity but be open for changes during the whole life-span of the programme!

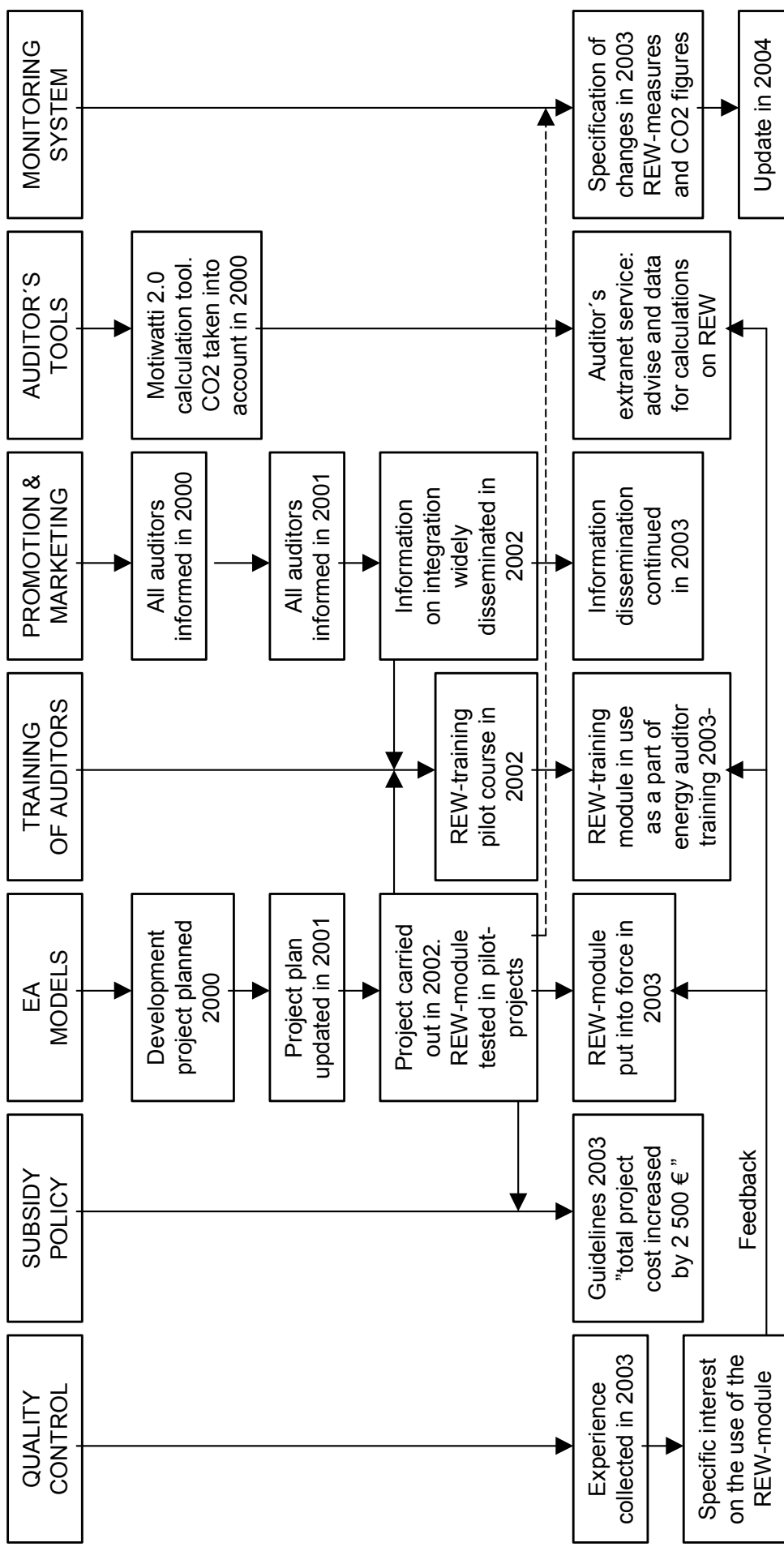


Figure 8.3 The cross-effects in other basic elements



9 Conclusions

The following list of conclusions has been discussed and commonly agreed by the project team. The presented conclusions are not in any specific order.

1. Energy audit programmes are effective and “low-cost” tools for improving energy efficiency, generating energy savings and reduction in CO₂ emissions, especially when combined with other measures and/or schemes e.g. with voluntary agreements.
2. Energy audits can significantly raise awareness on energy efficiency in the audited companies of the target sectors.
3. If all 12 basic elements are in place, an energy audit programme, operated as an independent programme, will produce energy audits with good quality. The message: good programme will bring in good results, poor programme poor results.
4. Energy audits should be used as tools in different connections. The message: e.g. in an energy labelling scheme the label should be based on an energy audit.
5. Energy audit activity should always be a mid-term or a long-term activity with a long-term commitment from the authority. The message: the up-front cost is high and good cost-effectiveness is achieved only after several years of operation.
6. The programme developer should always make an analysis on the existing situation. Not all of the 12 basic elements are necessary to develop. The message: existing schemes and networks can be utilised but pros and cons must be understood.
7. When the development and planning of the programme is started, the programme developer should know the available resources of the key players. The message: there is no point to develop a programme, which the Operating Agent cannot take care of e.g. due to lack of personnel, or a large programme if the Administrator is short in financial resources especially when subsidies are used as an implementing instrument.
8. The effort put to the programme should be analysed against the importance and lifetime of the programme. The message: if the programme is important, adequate resources must be available, if the expected or intended lifetime is short (which is not recommendable) there is no point spending time and money developing state-of-the-art basic elements.
9. The progress and results of the programme should be continuously controlled and periodically evaluated. The message: all changes are really slow to put in force, possible problems and barriers can be removed in time only if the feedback is continuous, creditability of the results is better if confirmed by official evaluations.



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10. The Administrator and the Operating Agent must be prepared to frequently update the programme. The message: a programme is never completely ready, at least the market place and the environment is continuously changing.
 11. Voluntary energy audit programmes are more complex and laborious to administrate but bring in better results than mandatory/compulsory programmes. The message: with mandatory programmes the commitment from the clients side is weak, the number of audits might be high but a lot of will be as light and cheap as possible.
 12. Voluntary programme can be changed into compulsory/mandatory later. The message: if the programme is cost-effective, has a good reputation and the volumes are at a significant level, the change from voluntary to compulsory/mandatory is not a major change for the market place – many clients have carried out the audits already and many would do it in any case.
 13. Programme developers should utilise the existing knowledge and learn from the experiences of the other programme developers and Operating Agents. The message: why repeat the same mistakes, better to choose from the good and tested options.
 14. Last but not least – there is no standard way of implementing a programme but a variety of different approaches. The message: examples on well functioning programmes exist but in each country the optimal solution will be a unique application.



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2. CR Belgium, September 2002
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5. CR Denmark, September 2002
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1. Energy Audit Management Procedures "AUDIT", Final Report, March 2000
2. Source Book for Energy Auditors, IEA 1987

Appendix 1

Energy Audit Programmes and Other Programmes and Activities Related to Energy Audits

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Austria		The Branch Concepts for industry and trade	Ecoprofit
		Energy Audits in industry	Energy audits for existing buildings
		Energy saving programme for federal buildings	ÖKO-Audit / EMAS
			Prepare
Belgium	Electricity distribution company Energy Audits	Energy audit for the public sector: the “guidance” programme (Walloon region)	Regional Development Companies
	Energy Audits in Industry in the Flanders region	The AGEBA programme for local authorities buildings in the Walloon region	
	Energy Audits for industry in the Walloon region		
	Audits for the residential sector in the Walloon region: Guichets de l’énergie		
Denmark	Energy management (ELO) Energy labelling (EM)	The CO ₂ Scheme	The Oil Burner Check
Finland	Energy Audit Programme	Voluntary Agreement Scheme	Environmental Management Systems
		Technical Condition Assessment Programme for residential sector	Condition Assessments in the tertiary sector
			Air Audits
France	Decision Making Support Scheme (DMSS)	Energy labelling in the building sector	OPATBs

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Germany	The Federal Energy Conservation Programme "Energiesparberatung vor Ort"	Öko-Audit / federal Germany	Commercial energy audits
	Nordrhein-Westfalen: Initial consulting („Initialberatung“)	Bavaria (Bayern): Strategic and rationalising audits for SMEs	Energy Audit Model "Energie Beratung" in project management
	Nordrhein-Westfalen: Energy check in Buildings („Gebäudecheck Energie")	Baden-Württemberg: Energy check for SME	
	Nordrhein-Westfalen: Solar check in buildings („Solar-Check NRW")		
	Nordrhein-Westfalen: energy saving week „e-fit“ („Aktionswoche E-Fit“)		
Greece	Baden-Württemberg: Energy check for Residential Buildings („Energiesparcheck")		
		Operational Programme for Competitiveness (OPC) 2000-2006	Commercial Audits for TPF/EPC EMAS pilot projects
		CRES Energy Bus	
		JMD 21475/4707/98 & Regulation for RUE in Buildings (KXEE)	
Ireland		Action Programme for Energy Efficient Public Buildings within CSF 2000-2006	
		Annual Self-Audit and Statement of Energy Accounts Scheme	

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Italy		Utility Demand Side Management programmes	
		Green house gas emissions reduction programme	
		Appointment of an Energy Manager	
		Technical Assistance and System Actions (PON ATAS)	
Luxembourg	The Voluntary Energy Audit Programme for large buildings and industry	Voluntary Agreements	The P.E.E.C. Support to low energy housing
Netherlands	EMA Programme	LTA I	
		LTA II	
		Energy Performance Advice (EPA)	
Norway		Building Network	Oslo Econ Fund
		Industrial Energy Efficiency Network (IEEN)	
Portugal		Regulation for Energy Management (RGCE)	Regional Energy Efficiency Centres Energy Certificatio
		POE - Operational Programme for Economic Activities - measures 2.5 and 3.2 (2000-2006)	
Spain	-	-	-
Sweden		EKO Energy Programme	

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Switzerland	-	Target agreements scheme in industry	
		MINERGIE programme for buildings	
		ENERGHO programme for public buildings	
		"SwissEnergy for municipalities " and the Energy City label	
The United Kingdom		Action Energy / Surveys	Energy Saving Trust

CEECS

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Bulgaria		Programme MEEP – Municipal Energy Efficiency Programme	
Czech Republic	Energy Management Act	State Programme of Support of Energy Savings and Use of Renewable and Secondary Energy Sources	Programme for financial support of repair of panel buildings
Estonia	Energy Auditing Programme	The Voluntary Agreement Scheme	Environmental Management Systems (EMS)
		The Condition Assessment Scheme	Condition assessments in the tertiary sector
Hungary	Széchenyi Plan Audit Subprogramme	1. Energy Saving programme, 2. UNDP/GEF Municipal Energy Efficiency, 3. PHARE 4. German Coal Aid	
Latvia		Project “Assistance to implementation of the Energy Efficiency Fund” Latvia Project “Energy Efficiency and Housing Studies Component” Project “Implementation in Latvia of the EU-SAVE Directive 93/76 EEC and the EU-Directive on Energy Performance of Buildings”	
Lithuania		Energy Efficiency Housing Pilot Project (EEHPP) Municipal Infrastructure Development Program (MIPD) 2000-2004 Education Improvement Project (EIP)	Housing Advisory Agency (HAA) Lithuanian Energy Consultants Association (LECA)

Country	Energy Audit Programme	Other Programme related to Energy Auditing	Other Activity related to Energy Auditing
Poland		The Thermo-Modernisation Programme and Fund	National Fund for Environmental Protection and Water Management ("NFOŚiGW") EcoFund
Romania			LTA-Long Term Agreements Short term & Long term action plans Energy Efficiency Energy Audits Monitoring and targeting
Slovak Republic		Programme for Support of Energy Savings and Utilisation of Alternative Energy Sources	
Slovenia	Energy Auditing Programme	Energy advisory network in Slovenia – ENSVET Voluntary Agreements (Planned)	Energy consulting to larger industrial energy consumers Fund for Energy Efficient Investments Seminars, Workshops, Awards